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BULK CERCLA WASTE MANAGEMENT
ELEMENT THREE OF
THE CERCLA HAZARDOUS WASTE IRA
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TASK ORDER NO. 9

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THIS DOCUMENT ADDRESSES THE MANAGEMENT OF BULK COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPREHENSIVE AND LIABILITY ACT OF 1980 (CERCLA) WASTE AT RMA. THE PROPOSED ACTIVITIES CONSISTS OF THE ASSESSMENT, DESIGN, CONSTRUCTION, OPERATION, AND CLOSURE OF A FACILITY TO MANAGE BULK CERCLA WASTES.

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Element Three of the CERCLA Hazardous Waste Interim Response Action (IRA) addresses the management of bulk Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) waste at Rocky Mountain Arsenal (RMA). The proposed activities consist of the assessment, design, construction, operation, and closure of a facility to manage bulk CERCLA wastes. The temporary management facility will be designed for a minimum five-year life and will be used to manage bulk contaminated soil and building rubble generated during investigative activities and IRAs. The record of decision (ROD) for the RMA will define the final disposition of these wastes and the use of this facility during its remaining five-year life.

Projected Requirements

To date, potentially contaminated Investigation-Derived Wastes (IDW) generated during investigation and monitoring activities at RMA have been stored and managed in drums. The volume of drummed soil IDW currently being managed is approximately 1,700 cubic yards. The volume of IDW and IRA wastes to be generated during the next several years is estimated to range from 21,000 up to 33,000 cubic yards. All except about 5,000 cubic yards of this waste will consist of potentially contaminated soil. The remaining 5,000 cubic yards will consist of building debris generated during a pilot demolition study of five buildings in the South Plants.

Managing this volume of CERCLA waste using current management practices is highly inefficient and cost prohibitive. Therefore, the Program Manager, Rocky Mountain Arsenal (PMRMA) intends to consolidate potentially contaminated CERCLA wastes that will be generated from future monitoring, RIs, treatability studies, and IRAs into a management facility selected and designed based on the results of an engineering and cost evaluation assessment contained in this document. Currently stored waste may also be placed in this facility. The decision process involved defining design criteria and operational requirements; developing alternative bulk CERCLA waste management concepts; evaluating both vacant sites and existing buildings for their potential use in bulk CERCLA waste management; assessing the technical, regulatory, and cost-implications of the facility and site alternatives; and selecting a preferred alternative to meet the design requirements.

Alternatives

The design criteria developed as a result of a review of regulations and operational requirements indicated the bulk CERCLA waste management facility should consist of one or a combination of the following:

- A transfer facility for off-site disposal
- An on-site container storage facility
- An on-site waste pile

The transfer facility for off-site disposal would consist of an existing structure, and the primary costs of the alternative would be related to transportation and disposal at an off-site RCRA-permitted facility.

The assessment of an on-site container storage facility evaluated both continued handling of waste in drums (essentially the "no-action" alternative) and the management of wastes in relatively large roll-off containers. Some usage would be made of existing buildings for both container storage alternatives; however, new buildings would also be required.

The on-site waste pile alternatives evaluation consisted of four major configurations:

- Minimal-technology outdoor waste piles without leachate and runoff collection
- Outdoor facilities with engineered liners and leachate and runoff collection systems
- Indoor facilities utilizing existing and new structures
- An indoor/outdoor "hybrid" facility that would allow the wastes to be placed and capped under the shelter of movable structures

The hybrid alternative avoids the generation of large quantities of potentially contaminated runoff and leachate while avoiding the cost of large containment buildings.

Alternatives Evaluation

The conceptual management alternatives described above were screened and a site selection process was conducted to identify a preferred alternative implemented at a preferred site. The following evaluation criteria were used to screen the alternatives:

- Overall protection of human health and the environment

- Compliance with applicable requirements
- Short-term effectiveness
- Implementability
- Cost effectiveness

These criteria are among those presented for evaluating alternatives in EPA guidance for conducting remedial investigations and feasibility studies. Other criteria used in CERCLA feasibility study evaluations (e.g., long-term effectiveness) are not applicable to the evaluation of a facility for the short-term storage of bulk CERCLA wastes. These other criteria relate to permanent closure and/or remediation.

A qualitative ranking procedure was used to evaluate the first four technical criteria. Preliminary cost estimates of the alternatives were made to judge cost effectiveness.

Selected Alternative Concept

The selected alternative involves managing the relatively large volumes of soil waste in indoor/outdoor hybrid waste piles and managing approximately 5,000 cubic yards of building debris in containers in existing buildings. Based on the technical ranking and evaluation of costs, the indoor/outdoor hybrid waste pile facility using movable structures will achieve the goals of the IRA as well or better than the other alternatives. The cost of this alternative will be approximately 5 percent higher than the lowest-cost substantively compliant alternative. The lowest-cost substantively compliant alternative, a 2-cell outdoor waste pile, received a relatively low technical ranking due to the volume of potentially contaminated runoff that would be generated. The overall lowest cost alternative, minimal technology outdoor waste piles without engineered leachate and runoff collections systems, was deemed to be non-compliant with applicable regulations.

The selected waste pile alternative combines the advantage of shelter of an indoor waste pile with the advantage of relatively low cost of an outdoor waste pile. To prevent contact with precipitation and the subsequent generation of potentially contaminated runoff, the facility will consist of wastes placed and capped in cells beneath a movable structure. The cells will be provided with synthetic geomembrane liners and leachate collection systems designed and constructed in general conformance with EPA guidance for lining waste containment facilities. The structures will consist of 60-foot-wide by 120-foot-long aluminum-frame fabric-covered structures. One to three of these structures will be required, depending on operational requirements. The cells placed in the structures will be 45 feet wide and up to 500 or 600 feet

long. The waste will be placed and capped using conventional outdoor waste pile techniques under the shelter of the movable structure. The structures will be moved along the length of the cell on a track system.

The waste piles will be constructed in two phases on Site 11. Phase I will be designed to accommodate 30,000 cubic yards of material and will consist of four cells, liners and leachate collection systems for these cells, and the moveable structures to be used for the entire facility. Phase II, which will be designed to accommodate another 30,000 cubic yards or more of material, will also consist of four cells. The second phase can utilize the same moveable structures used in Phase I.

The site selection process identified three preferred sites: Sites 11, 1 and 2. Site 11 is located in the south central portion of Section 36, just south of Basin A. Site 1 is located at the northwest corner of Section 36. Site 2 is located near the southeast corner of Section 36 just east of the decontamination pad. Considering the relative chemical contamination of the three sites, Site 11 was selected as the preferred alternative. Site 11 is underlain by contamination and is, therefore, the site least likely to be impacted by the waste management facility and would generate the smallest volume of additional waste materials in the event that a leachate release occurred. A complete discussion of the site selection process is found in Section 4.0.

1.0
INTRODUCTION

The objective of this draft Decision/Preliminary Design Document, Bulk CERCLA Waste Management, is to assess waste management alternatives, select a preferred alternative, and then to site and design a temporary facility to manage bulk CERCLA wastes for the Project Manager for Rocky Mountain Arsenal (PMRMA). The temporary management facility will be designed for a minimum five-year life and will be used to manage Investigation-derived Wastes (IDW) such as drill cuttings, sediments, soils, and building debris from remedial investigations (RIs), monitoring activities, and treatability studies. The facility will also accept bulk wastes generated by IRAs. The record of decision (ROD) defining the final disposition of these bulk CERCLA wastes is expected to be issued in 1994, at the earliest. The ROD will also address the use of the bulk CERCLA waste management facility during its remaining five-year life.

1.1 BACKGROUND

The U.S. Army has been conducting hazardous waste Remedial Investigations (RIs) and Feasibility Studies (FSs) at Rocky Mountain Arsenal (RMA), Denver, Colorado, for a number of years. The RI/FS activities have been conducted under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and have utilized the CERCLA Interim Response Action (IRA) process, where appropriate, to expedite solution of hazardous waste conditions at the facility. The RI and IRA activities have generated contaminated materials [e.g., soils, personnel protective equipment (PPE), building debris] and are anticipated to continue to generate even larger volumes of such materials during the next several years.

To date, potentially contaminated IDW generated during CERCLA investigation and monitoring activities at RMA have been stored and managed in drums, and wastes generated during IRAs have been managed within each individual IRA location. The PMRMA now desires to manage IRA-generated wastes, along with soil IDW, in a facility that will accommodate the volumes of waste that will be generated until a final remedy is implemented.

The current practice of managing IDW in drums has nearly exhausted the storage capacity of the current waste-management warehouses and has incurred high annual costs for monitoring and maintenance of a relatively small volume of material. The volume of drummed soil IDW currently being managed is approximately 1,700 cubic yards. The volume of IDW and IRA wastes to be generated during the next several years is estimated to range from 21,000 up to

33,000 cubic yards. Managing this volume of CERCLA wastes using current management practices will be highly inefficient and cost-prohibitive. Therefore, the PMRMA intends to consolidate potentially contaminated CERCLA wastes that will be generated from future investigations and IRAs into a management facility to be selected and designed based on the results of an engineering and cost evaluation of alternatives.

On January 14, 1992, PMRMA submitted a Technical Study for the expansion of the CERCLA Liquid Waste Interim Response Action to the U.S. Environmental Protection Agency. The Technical Study proposed to amend the "Pretreatment of CERCLA Liquid Wastes Interim Response Action" of the Federal Facility Agreement to encompass a broader range of waste streams and waste management activities for both on-post and off-post operable units. The expansion has three elements:

- Element One - Approval for management options for disposal and/or treatment of hazardous waste which has been or will be placed in storage areas on RMA and which have not been addressed in another IRA. Waste streams will include RI/FS wastes; IRA wastes; and miscellaneous wastes from vehicle, grounds, building maintenance, and items "found on post."

- Element Two - Approval for management options relating to remediation of selected equipment and sites contaminated with polychlorinated biphenyl (PCB) wastes. These wastes will primarily consist of contaminated soil and building rubble.

- Element Three - Selection and approval of an on-site facility for managing solids which are bulk hazardous wastes (as defined pursuant to RCRA).

Element Three is the focus of this document.

1.2 PURPOSE

To ensure the cost-effectiveness and usefulness of the bulk CERCLA waste management facility, the following project objectives were established for the assessment and preliminary design activities:

- Define preliminary design criteria and operational requirements.

- Develop alternative bulk CERCLA waste management concepts.

- Survey a minimum of three sites for facility location (sites may be existing buildings, new sites, or a combination of these).

- Assess the technical, regulatory, and cost implications of the facility and site alternatives.

- Select a preferred alternative to meet design requirements.

- Prepare preliminary design drawings for the chosen alternative.

1.3 SCOPE

The assessment of bulk CERCLA waste management alternatives involved the identification of management concepts and the identification of alternative types of facilities, operational configurations, and sites. Work items conducted during the assessment are briefly summarized below:

- Conceptual Alternative Identification and Screening

  - Review previous RI data and assessments to identify characterization and volumes of CERCLA waste requiring management.

  - Perform regulatory review and analysis.

  - Identify facility ope ational requirements.

  - Develop facility design criteria.

  - Develop conceptual management alternatives.

  - Screen conceptual alternatives against design criteria and operational and regulatory requirements.

- Site Selection

  - Review previous RI data and assessments to identify potential sites for screened alternatives.

  - Develop facility site selection criteria.

  - Conduct field reconnaissance of potential management facility sites.

  - Screen potential sites to identify a preferred site, and possibly one or two alternative sites.

- Identification of Alternatives

  - Analyze conceptual and site alternatives. Screening criteria included overall protection of human health and the environment, compliance with applicable requirements, short-term effectiveness, implementability, and cost effectiveness.

  - Select preferred alternative and prepare preliminary design drawings.

  - Prepare a draft decision document that summarizes the results of the assessment, selects a preferred alternative, and presents the preliminary design drawings for the preferred alternative.

  - Finalize decision document considering comments made by the Organizations and State (OAS) and the public.

1.4 DOCUMENT ORGANIZATION

Section 2.0 of this report summarizes the projected volumes and waste characterizations of the wastes anticipated to be managed at these facilities. It also presents the proposed facility operational requirements and design criteria.

Section 3.0 summarizes the identification and screening of conceptual waste management alternatives and presents the selection of the preferred alternative. This process involved combining the results of the regulatory review with the facility operational requirements and design criteria to develop conceptual waste management alternatives. The conceptual

management alternatives were then combined with the results of the siting process described in Section 4.0 and screened to identify the preferred management alternative implemented at the preferred site.

Section 4.0 presents the waste management site selection process. This process started with a review of existing information in conjunction with the development of general siting criteria to identify candidate sites. After the preliminary identification of sites, further regulatory and operational criteria were developed to allow more detailed screening of sites. In the early stages of the assessment, the sites with the three highest scores were considered to be suitable locations for the management facility. Once the preferred waste management alternative was selected, the preferred site was chosen.

Section 5.0 describes the design, construction, and operation of the selected alternative. The preliminary design drawings presented in Appendix A are referred to throughout this discussion. Section 6.0 describes the chronology of significant events pertaining to Element 3 of the CERCLA Hazardous Waste IRA. Section 7.0 summarizes the IRA process as described in the FFA. Section 8.0 presents the results of a review of Federal environmental regulations conducted to evaluate their relevance to the siting, design, and operation of the bulk CERCLA waste management facility. Section 9.0 addresses consistency with the final remedial action and Section 10.0 presents the references used during the preparation of this document.

This section summarizes the results of a review of information concerning waste volumes to be placed in the bulk CERCLA waste management facility and characterization of the wastes, and presents operational requirements and design criteria for the facility.

2.1 PROJECTED WASTE VOLUMES AND CHARACTERIZATIONS

Available RI data and other documentation existing in the RMA resource information center (RIC) were reviewed to evaluate the composition, characterization, and volumes of waste to be placed in the management facility. The following discussion summarizes existing information and describes assumptions that were required to support the development of design criteria.

PMRMA has primarily identified four general waste streams that will contribute wastes to the management facility: (1) any potential action to prevent precipitation runoff from the South Plants from contaminating surface water, (2) building rubble generated during a pilot demolition study of five buildings in the South Plants, (3) Basin F Pond A subgrade and liner materials, and (4) soil IDW primarily obtained from wells and boreholes. Table 2-1 shows the estimated volumes of material by source and a general characterization of the wastes from each source. The following subsections describe each of these waste streams and assumptions required to develop a management facility design volume.

2.1.1 South Plants Drainages

The South Plants Drainages Assessment was in its early stages at the time of this waste management assessment report. The assessment for the South Plants Drainages, which includes approximately 6,000 lineal feet of the Sand Creek Lateral in Section 2, will evaluate the potential for migration of surface contamination with precipitation runoff. The CARs for Sections 1 and 2 made the assumptions that remediation of the South Plants Drainages could involve excavation along 22,000 lineal feet of drainage ditches in the South Plants to a depth of 10 feet and width of 10 to 20 feet, resulting in a soil excavation volume of approximately 180,000 to 200,000 cubic yards. However, recent review of precipitation runoff and surface soil contamination data conducted during the planning stage of the assessment for the South Plants Drainages indicates that significant migration of contamination with precipitation runoff may

not be occurring. The Field Investigation for this assessment will be conducted in the spring of 1992. Excavation of the large quantities of soil described in the CARs may be impractical.

During the planning stage of the assessment, the PMRMA believed that any potential action for the South Plants Drainages might involve providing one or two stormwater detention ponds along the south periphery of the South Plants. For the purpose of estimating the volume of waste soils requiring management, it was assumed that excavation required for the construction of two 200-foot-square storm detention ponds would generate between 10,000 and 20,000 cubic yards of soil. The chemical characterization of the excavated soils will depend on the locations of the excavations; however, the description of contaminants presented in Subsection 2.1.2 for the SPSA ditches generally applies to the areas where detention ponds are likely to be sited. It is now known whether these soils will be wet or dry.

TABLE 2-1
WASTE SOURCE SUMMARY

SOURCE	VOLUME (cubic yards)	PHYSICAL CHARACTER-IZATION	CHEMICAL CHARACTERIZATION
South Plants Drainages	10,000-20,000	Soil	Similar to SCL characterization - will vary depending on sites for basins
Building debris	5,000	Concrete, Wood, Steel, etc.	Uncharacterized
Pond A subgrade	3,000-5,000	Soil, Plastic Liner	Saturated salt solution, heavy metals, OCPs, and trace levels of chemical agent degradation compounds.
Drill cuttings	3,000	Soil	Mix of organics and metals
TOTAL	21,000 - 33,000		

2.1.2 Building Debris from Pilot Demolition Study

The pilot demolition study planned for five buildings in the South Plants will generate building rubble consisting primarily of broken up concrete, wood, steel structural members, plumbing, and other miscellaneous building materials. The buildings planned for demolition during the pilot study are Buildings 317, 433, 523G, 412, and 431. Existing data on these buildings indicate

a total of approximately 5,000 cubic yards bank volume will be generated by their demolition. The chemical characterization of the building debris is not known at this time; however, it is assumed that building debris contaminated with army agents will not be placed in the management facility. It is possible that segregation into as many as 40 discrete piles could be required.

2.1.3 Basin F Pond A Subgrade and Liners

A potential for soil removal exists beneath the geomembrane liner of the Pond A impoundment at the Basin F cleanup site. Pond A was used for temporary storage of Basin F liquids but will be emptied during the operational life of the bulk CERCLA Waste Management facility and the upper liner surface decontaminated. Decommissioning of Pond A will involve removal of the lining system and an estimated ½-foot of underlying soil. For the purpose of sizing the bulk CERCLA Waste Management Facility, it is estimated that 3,000 to 5,000 cubic yards of soil from Pond A will require management.

Prior chemical testing has found that Basin F liquid is saturated with common salts, ammonium salts, and other nitrogen-containing compounds. The liquid also contains heavy metals such as copper and arsenic, low levels of pesticides and byproducts of pesticide prediction, and trace degradation compounds of chemical agent. If the Pond A subgrade soils are contaminated, the contaminants are likely to consist of Basin F liquid constituents.

2.1.4 Drummed Soils

It is estimated that IDW consisting of soils are currently stored in 4,000 to 6,000 drums. This amounts to approximately 1,300 to 2,000 cubic yards of soil IDW. For the purpose of this assessment, it was assumed that the total volume of IDW, including 1,700 cubic yards of existing drummed soils, will contribute 3,000 cubic yards to the bulk CERCLA waste management facility. Some of these wastes may contain free water when they are removed from the ground. Therefore, they may either be handled as the current drummed wastes are, which requires mixing wet soils with a desiccant, or they may be placed in a facility designed to contain wet wastes. Characterization of the existing drummed wastes will be based on sampling and analytical chemistry testing. The characterization of future IDW will generally be based on site characterization and field monitoring during sampling, although some analytical chemistry testing will be conducted for wastes obtained in some areas.

2.2 FACILITY OPERATIONAL REQUIREMENTS AND DESIGN CRITERIA

The management facility will serve as a receiving and sorting facility for bulk CERCLA wastes generated at RMA. These materials will include contaminated soils, drill cuttings, and building debris resulting from investigations and IRAs. The materials may be sorted by source location (section of origin: e.g. on- versus off-post), material type (e.g., wood, soil, concrete, or steel), type of contamination (e.g., organics, metals, or pesticides), and the physical condition of the material (e.g., with or without free liquids). They may also be sorted based on potential disposal or treatment methods that may be utilized in the future.

The original waste volume used to size the facility was 70,000 cubic yards of bulk CERCLA waste. As discussed in Subsection 2.1, the updated estimated maximum volume of waste that may be placed in the management facility is approximately 33,000 cubic yards. The original 70,000 cubic yard volume was used throughout the Selection of Preferred Waste Management Alternative section (Section 4.0). The use of this volume for the assessment is valid as it was used solely for developing relative costs. The estimated volume of demolition debris is approximately 5,000 cubic yards.

A soil volume of 30,000 cubic yards was used to size the first phase of the management facility. As the first phase of the facility begins to be utilized, the need for additional capacity can be assessed. The building debris will be managed in containers in existing buildings.

2.2.1 Operational Requirements

To function effectively, the management facility must satisfy certain operational criteria. The following operational features were identified during the assessment based on the physical waste characterization, estimated waste volumes and the uncertainty of these volumes, locations of waste sources, existing RMA facilities, and the potential final disposition of the wastes available:

- Central location
- Modular design with multiple sections, cells, or structures
- Ease of material removal in the future for treatment or disposal
- Limited atmospheric emissions from the contaminated materials

- Restricted contact of contaminated material with un-contaminated materials
- Restricted access to the contaminated materials by unauthorized personnel
- Ability to collect leachate (depending on material characterization)
- Ease of accounting for locations of different waste characterizations in facility
- Ability to operate or cover facility in inclement weather

The regulatory operating requirements identified in Subsection 8.2 result in the following facility operational criteria:

Container Storage

- Containers holding hazardous waste must be in good condition.
- Containers must be constructed of materials compatible with waste stored.
- Containers holding hazardous waste must be handled in a manner which prevents leaks.
- Container storage areas must be inspected weekly.
- Containment systems must be operated to drain and remove liquids.

Waste Pile

- Waste piles must be inspected weekly and after storms.
- During construction, the liners and cover system must be inspected for damage.
- Ignitable or reactive waste must not be placed in a waste pile unless the waste and waste pile satisfy all applicable requirements of 40 CFR 264.256.
- Hazardous waste must not be piled on the same base as incompatible wastes or materials or where incompatible wastes were previously piled.

- Incompatible wastes and materials must not be placed in the same pile.

- Waste piles must be operated to prevent runon to the active portion of the pile of storm waters from a 25-year, 24-hour storm.

- Leachate collection systems must be operated to prevent buildup of excess head on the liner.

The general operational requirements discussed above dictate a number of design requirements for the facility. A modular design is desired due to the uncertainty of the total waste volume, and to provide flexibility regarding the segregation of wastes with different characteristics. A modular design will involve the use of containers, the use of a relatively large number of relatively small waste pile cells, or larger cells with internal barriers to separate different wastes. If internal barriers are used, the volume of waste will be increased. Container storage would be accomplished inside buildings; small waste piles could be located either indoors or outdoors; and large waste piles would be located outdoors. The removal of wastes from the facility during closure will require less effort if buildings are used. Wet wastes may be managed by either containerizing the material and decanting the free liquids or providing leachate collection systems beneath waste piles.

2.2.2 Design Criteria

The operating criteria described in Subsection 2.2.1 result in the following regulatory design criteria for container storage and waste piles:

<u>Container Storage</u>

- Container storage areas must have a containment system that can contain 10 percent of the volume of containers or the volume of the largest container, whichever is greater, unless:

  - The waste contains no free liquids, and

  - The facility is designed to drain precipitation, or containers are protected from contact with precipitation.

- Containment systems must have a base sufficiently impervious as to contain leaks and spills until the release is detected and removed.

- Containment systems must be designed to prevent runon or to contain runon.

- Containers holding ignitable or reactive waste must be at least 50 feet from the facility's property line.

- Hazardous waste containers must be separated from units storing substances incompatible with the waste.

Waste Pile

- Outdoor waste piles must have a liner constructed of materials to prevent failure due to pressure gradients, physical contact with the waste, climatic conditions, stress of installation, and the stress of daily operation.

- Liners must be placed on a base capable of providing support to the liner and preventing failure of the liner.

- Liners must be installed to cover all surrounding earth likely to be in contact with the waste or leachate.

- Outdoor waste piles and piles storing wet wastes must have leachate collection and removal systems. The revised 40 CFR 264 Subpart L regulations promulgated on January 29, 1992 require that waste piles requiring liners be provided with 2 liners separated by a leak detection system (Subsection 8.5.2).

- Waste piles requiring liners and leachate collection are subject to the groundwater monitoring requirements of 40 CFR 264 Subpart F. This requirement will result in at least one upgradient and three downgradient wells.

- Leachate collection systems must be constructed of materials resistant to the waste and leachate managed in the pile.

- Leachate collection systems must prevent collapse under pressures exerted by wastes, cover materials, and equipment.

- Leachate collection systems must be designed for sufficient capacity without clogging.

- Waste piles must include runon control systems designed to prevent flow onto the active portion of the pile during at least a 25-year occurrence, 24-hour duration storm.

- Waste piles must be located inside a shelter or provided with an impervious cap to protect the wastes from precipitation.

- Outdoor waste piles must include runoff management systems designed to collect and control a 25-year, 24-hour storm.

3.0
SELECTION OF PREFERRED WASTE MANAGEMENT ALTERNATIVE

Before proceeding with the preliminary design of the bulk CERCLA Waste Management facility, PMRMA conducted an assessment of available waste management alternatives. The alternatives development and screening processes employed to select the preferred alternative are discussed in this section.

As discussed in Subsection 2.1, the volume of waste currently estimated to require management in the proposed facility is 33,000 cubic yards. However, at the time of the assessment described in this section, the estimated volume was 70,000 cubic yards. The results of the assessment based on this larger volume are still considered to be valid because the volume was used only to evaluate relative costs. The relative costs will be comparable for the downsized facility.

3.1 DEVELOPMENT OF CONCEPTUAL MANAGEMENT ALTERNATIVES

The design criteria developed as a result of the evaluation of predicted waste volumes and characterizations, regulatory review, and identification of operational requirements indicate the bulk CERCLA waste management facility will consist of one or more of the following options:

- A transfer facility for off-site disposal
- An on-site container storage facility
- An on-site waste pile

Several considerations are common to all RMA waste management options. For the on-site management facility alternatives, it is desired to have a centrally located facility with a modular design to allow flexibility regarding the volume of wastes requiring management. There is uncertainty regarding both the proportions of wet and dry waste and the total volume of waste. Waste characterizations are also not defined. The following subsections present descriptions of conceptual management alternatives developed considering their effectiveness and implementability within the operational requirements and regulatory framework that have been identified.

3.1.1 Alternative 1 - Off-site Disposal

This alternative consists of removal of all bulk CERCLA wastes from the RMA and disposal at an off-site facility. For the assessment, it was assumed that management of the wastes would not involve treatment of bulk IRA wastes. These wastes would be loaded into trucks at the IRA site and transported directly to an off-site disposal facility. Costs of any treatment required would be included in the IRA costs. However, a crew of two full-time technicians would be required to track all wastes and to handle and stage drummed wastes generated during drilling and sampling activities. These technicians would work out of the existing waste management building at the RMA so no facility costs would be associated with this alternative.

3.1.2 Alternative 2 - Container Storage

This alternative assumes that all bulk CERCLA wastes generated will be managed in accordance with 40 CFR Part 264 Subpart I, container storage. A container is defined as a portable device in which a material is stored, transported, treated, disposed, or otherwise handled. If the wastes contain free liquids, the container storage area must be provided with secondary containment.

For the assessment of alternatives, two general subalternatives were evaluated for container storage. The first, Alternative 2a, is to manage the wastes in drums. Since this is the management practice currently being used, this alternative essentially constitutes the "no action" alternative. Alternative 2b is to manage the wastes in significantly larger containers. Roll-off containers and cargo containers were both considered. Roll-off containers or other similar containers that can be loaded and unloaded using a specially equipped truck were selected for the assessment since they provide more versatility at both the point of waste generation and at the management facility. Special equipment would consist only of the truck and a large forklift.

For both Alternatives 2a and 2b, some use would be made of existing buildings. However, there is not sufficient storage capacity in all of the buildings that have been identified for potential use, and it is assumed that only a portion of the potential areas identified would actually be used. Subsection 5.2 describes existing buildings identified as having a potential for managing bulk CERCLA wastes. Approximately 380,000 square feet of building area was identified as potentially useful for drum storage, and approximately 270,000 square feet of building area was identified as potentially useful for roll-off container storage or waste piles. However, since other future uses are identified for portions of these buildings, it was assumed that no more than one-half of the potential area will be available.

For drum storage, it was assumed that four drums would be placed on 6-foot-square pallets and that the pallets may be stacked two high. This results in a building area requirement of 1,900,000 square feet. If 190,000 square feet of existing building area is utilized, over 1.7 million square feet of new building is required.

For roll-off container storage, an evaluation similar to that used above for drums results in a requirement for 585,000 square feet of new building area. For both drums and roll-off containers, it was assumed the containers may be stacked two high and that 50 percent of the floor space is required for aisles and staging areas. All containers must be visible for inspections. In both cases, handling would be conducted with forklifts.

Operation and maintenance of a container storage facility would be labor intensive, particularly in the case of drums. If wastes were managed the way they are now in drums, bulk wastes generated at IRA sites would be deposited in a staging area where the material would be drummed by hand. It is assumed that a crew of 32 laborers would be required to fill 255 drums per day, resulting in placement of 70,000 cubic yards of waste in a period of about 3.3 years. (It is possible this operation could be made more efficient if automated).

If roll-off or other similar containers were used, the bulk waste could be placed directly in them at the point of generation and then loaded and hauled by truck to the management facility. The capacity of each container would be between 10- and 20-cubic yards, depending on the density of the waste. The container would be unloaded from the truck at a dock, picked up by a forklift and moved to its storage location within the facility. The handling of roll-off containers would not be nearly as labor intensive as for drums; however, the management would still require weekly inspections of each individual container.

The closure of a container storage area would require removal of the containerized wastes from the management facility building and decontamination of the buildings. It is assumed that drums would be disposed with the wastes but that wastes would be emptied from roll-off containers, and the containers decontaminated and salvaged.

3.1.3 Alternative 3 - Waste Pile

In the context of RCRA, a pile is a non-containerized accumulation of solid, non-flowing waste that is used for treatment or stored. Functionally, several conceptual design configurations are applicable to a waste pile. Wastes may be piled in bulk within a structure such as a building that shelters the wastes from precipitation, or the wastes may be placed on the ground or in

excavations outdoors. If, however, the pile either contains materials with a potential to generate leachate or the pile is exposed to precipitation, then liners, leachate collection systems, and groundwater monitoring in accordance with 40 CFR Part 264 Subpart F are required. Groundwater monitoring would involve quarterly sampling and analysis of four new wells installed for the facility, unless wells already exist at appropriate locations. As described below, various combinations of these alternatives were considered during the assessment.

As discussed in Subsection 4.2, approximately 270,000 square feet of existing building area was identified as having a potential for siting of waste piles. However, these buildings are scattered throughout an approximate 2-square-mile area, and it is assumed that not all of these buildings will be available for bulk CERCLA waste management. If it is assumed that waste piles placed in buildings averaged 6 feet in height (12 feet maximum) and that 1/3 of the floor area is required for aisle space and staging, 720,000 square feet would be required to manage 70,000 cubic yards of bulk waste. Since no more than 1/3 to 1/2 of the existing building area identified is potentially available for waste management, and since operations in different buildings significant distances apart would be undesirable, it was decided during the assessment that any of the waste pile alternatives would require the construction of new facilities for all wastes except the building rubble.

As presented in Subsection 8.5.2, the new final rule on Liners and Leak Detection Systems for Hazardous Waste Land Disposal Units (F.R. Vol. 57, No. 19, January 29, 1992) requires a leak detection system and composite secondary liner beneath waste piles that previously required only a single liner and leachate collection system (i.e., all outdoor waste piles and indoor waste piles containing wet wastes). The Army has decided to utilize single liner systems, to site the facility on a contaminated site, and to request a regulatory waiver of the new requirements for secondary liners and leak detection. This decision is justifiable because even though the contaminants beneath the facility could be increased by using one liner instead of two, the volume of contaminated soil and groundwater requiring remediation would theoretically not be increased, provided the facility is entirely underlain by contaminated soils. Although Site 11 may not be entirely underlain by contaminated soils, there is significant soil and groundwater contamination. Groundwater contaminants on Site 11 include volatile halogenated organics, semi-volatile organics including pesticides, and sulfur compounds and dibromochloropropane.

To assess the waste pile alternatives, it was assumed that 65,000 cubic yards of waste soil would be placed in new facilities and that the 5,000 cubic yards of building debris would be managed in roll-off or similar large containers in existing buildings.

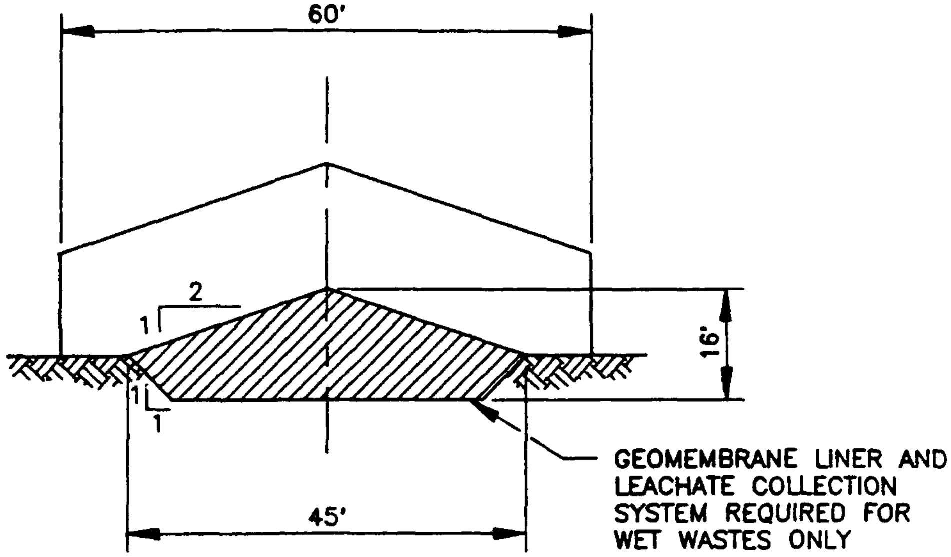
There are advantages to managing building debris in containers or piles in buildings rather than in capped waste piles. First, segregation into as many as 40 different material classifications may be required. Segregation into quantities this small would be inconvenient using a conventional waste pile operation. In addition, if building debris were to be managed in capped waste piles, the volume of waste would be increased by the cover soil required before capping a pile of building rubble. This is not a concern for soil wastes because a cap can be placed directly on the contaminated soils.

3.1.3.1 Alternative 3a - Indoor Waste Pile

A waste pile located inside a building has the advantage of avoiding the generation of leachate. Some capacity will be required to collect leachate from wet soils that are placed in the facility; however, potentially contaminated runoff and excess leachate will not be generated by precipitation falling on the wastes. The primary disadvantage of providing an indoor facility is the cost of the structures.

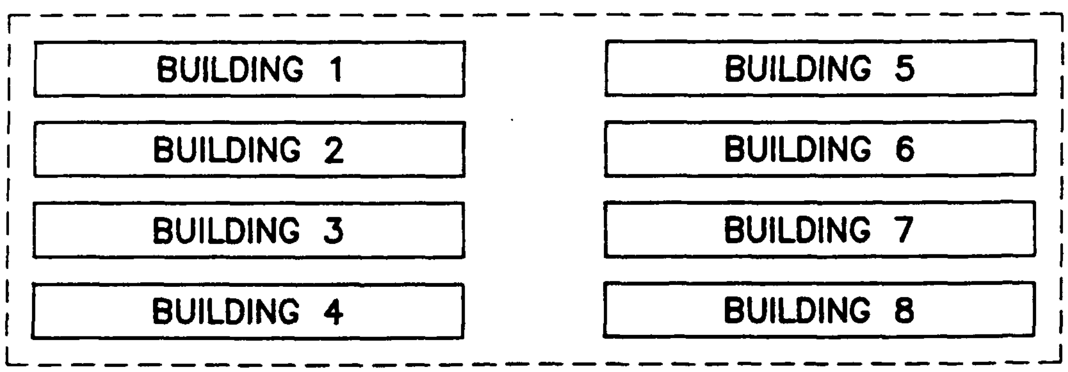
Figure 3-1 shows a general site layout and cross-section of Alternative 3a. Site grading prior to the erection of the structures would involve the provision of long, narrow troughs in which linear waste pile cells would be constructed. The long narrow configuration is a result of the economy of keeping building spans to approximately 50 to 60 feet. Once this span is exceeded, the unit cost for buildings increases. Based on the cross-sectional area of the waste pile shown in Figure 3-1, approximately 250,000 square feet of building area would be required. Liners and leachate collection systems would be provided only in some of these buildings as required by the placement of wet wastes. The cost evaluation of alternatives assumed leachate collection in two of the eight buildings. Site grading would provide for a 2 percent slope across the entire site in the longitudinal di. ection of the buildings for the drainage of both leachate within the waste pile cells and precipitation runoff outside of the buildings. Large doors would be provided at both ends of each structure for trucks and heavy equipment, and man doors would be provided approximately every 100 feet along both sides of each building. A portable ventilation system with a baghouse would be periodically moved along with the filling operation to control and collect dust generated during waste placement.

Operation and maintenance of waste piles placed inside buildings would consist of one or two front end loaders to place the waste, and a crew of two technicians to document the placement of wastes and conduct periodic inspections of the operation. The excavations would be surveyed, and periodic surveying of the piles would be conducted to document waste volumes



SECTION

INDOOR WASTE PILE
SCALE 1"=20'



PLAN

8 BUILDINGS 523' BY 60'
ENCLOSING CELLS

Job No. : 22831	BULK CERCLA WASTE MANAGEMENT ASSESSMENT – ALTERNATIVE 3a INDOOR WASTE PILE
Prepared by : RLB	
Date : 5/15/92	FIG. 3-1

RMOPT3A 1=200

and locations of different types of wastes. Once the wastes were in place within a structure, maintenance costs would be minimal.

Closure of indoor waste piles would require the removal of all wastes and potentially contaminated liner materials, removal of residual contamination resulting from leachate leakage or other contaminant migration, and decontamination of the buildings.

3.1.3.2 Alternative 3b: Outdoor Waste Pile

An outdoor waste pile may be used to avoid the costs associated with constructing buildings or other structurally supported covers. This type of facility would be constructed by grading the site to provide multiple cells recessed below the ground and separated by berms. The waste would be placed in the cells using techniques similar to those used for filling landfills.

The primary disadvantage of using an outdoor waste pile for management of bulk CERCLA waste is that relatively large quantities of leachate and potentially contaminated runoff could be generated. All cells would have to be provided with liners and leachate collection systems. All runoff from a partially filled cell would have to be collected until the cell was completed and capped. Even after a given cell was completed, any leachate generated would have to be collected until leachate flow stopped or the cell was closed (i.e., the wastes removed). The quantity of leachate generated after cell completion would be greater for a pile operated outdoors and exposed to precipitation than for an indoor cell, particularly if much of the waste is originally dry.

All leachate and potentially contaminated runoff must be collected and treated or disposed. It was assumed that any potentially contaminated waste liquids collected at the CERCLA bulk waste management facility would be pumped into tanker trucks and hauled to the RMA CERCLA Wastewater Treatment Plant. This would require that a lined detention pond (impoundment), designed according to the requirements of 40 CFR Subpart K, be provided at the waste pile site. These requirements involve providing two liners separated by a leak detection system. The impoundment would have to be sized to accommodate the volume of runoff generated by a 25-year occurrence, 24-hour precipitation event.

Two alternatives for outdoor waste piles were considered: (1) eight cells approximately 45-feet wide and 610-feet long excavated 5 feet below grade (Alternative 3b.1); and (2) two cells approximately 140 by 390 feet and 10 feet below grade (Alternative 3b.2). Alternative 3b.1 was evaluated because the larger number of smaller cells would maintain the desired flexibility of

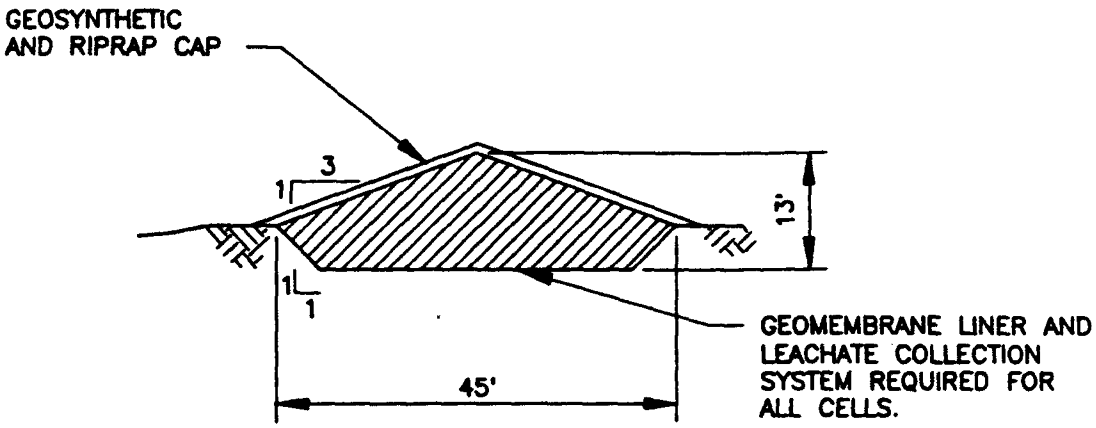
a modular design with respect to multiple waste characterizations and the uncertainty of the total waste volume, and would allow comparison with Alternatives 3a and 3c. Alternative 3b.2 was considered because a fewer number of larger cells is more economical in terms of excavation and liner quantities.

For evaluation purposes, an annual precipitation of 20 inches was assumed (the average at RMA is approximately 16 inches) (USDOC 1979), and a 25-year occurrence, 24-hour storm of 4 inches was used based on NOAA (1973). For Alternative 3b.1, it was assumed that two cells would be in operation at any given time. This results in a detention pond volume of 140,000 gallons and an annual volume of 700,000 gallons requiring treatment. The assessment was based on a detention pond 50 by 50 feet and 10 feet deep with 3 (horizontal) to 1 (vertical) (3:1) side slopes and a liner consisting of 30-mil lower and 40-mil upper HDPE geomembranes separated by a geonet leak detection system. Alternative 3b.2 would require a slightly smaller detention pond and would generate slightly less waste liquid than Alternative 3b.1.

The CERCLA Wastewater Treatment System Assessment Report (WES 1989) identifies a known waste stream volume of 65,000 to 125,000 gallons per month, primarily from RI/FS and IRA activities. The referenced assessment report recommends a system capacity of 100,000 gallons per month with 100,000 gallons of storage capacity. The treatment plant capacity is 15 gallons per minute, or 150,000 gallons per month if the plant is operated 8 hours per day 5 days per week (WES 1991). This implies a reserve treatment capacity of 600,000 gallons per year. Therefore, even though it is not desirable to generate large quantities of leachate and potentially contaminated runoff, there appears to be sufficient capacity to treat waste liquids generated by Alternatives 3b.1 and 3b.2 on site if the plant is operated more than 40 hours per week when necessary.

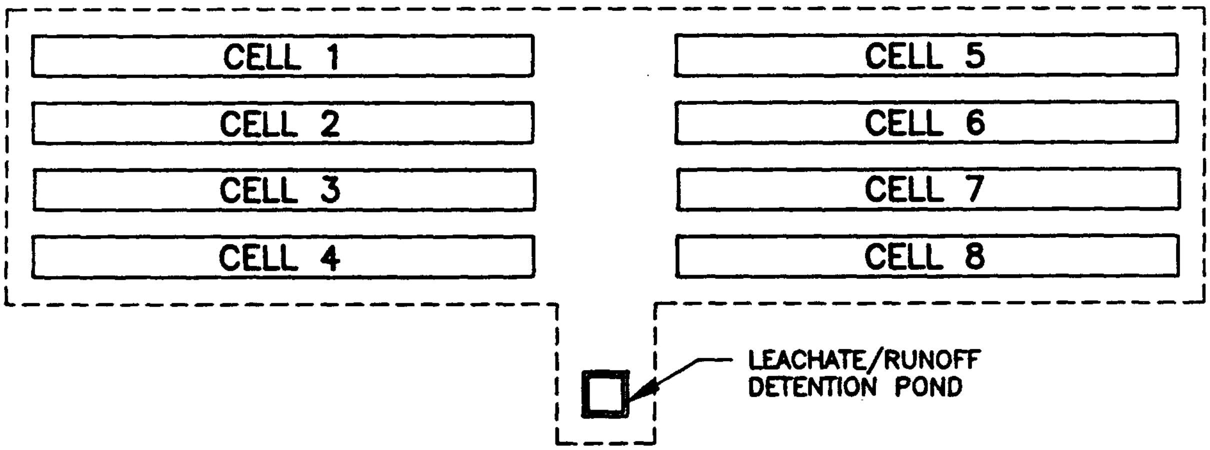
Figures 3-2 and 3-3 show cell cross-sections and layouts for Alternatives 3b.1 and 3b.2, respectively. For both alternatives, a 60-mil HDPE geomembrane liner overlain by a geocomposite (i.e., geonet/geotextile) leachate collection system would be used. Steep 1:1 side slopes could be used for Alternative 3b.1 due to the limited cell depth of 5 feet. A more conventional waste pile/landfill cell geometry with 3:1 side slopes would be used for Alternative 3b.2. A cap system consisting of a 40-mil HDPE geomembrane, an 8-ounce nonwoven geotextile drainage layer, and a 9-inch layer of crushed rock slope armorment would be used for both alternatives. Use of a high-friction textured geomembrane would allow 3:1 slopes to be used for the caps. Installation of liner and cap geosynthetics would follow EPA guidance and industry construction standards for hazardous waste land disposal facilities.

Woodward-Clyde Consultants



SECTION

SCALE:1"=20'



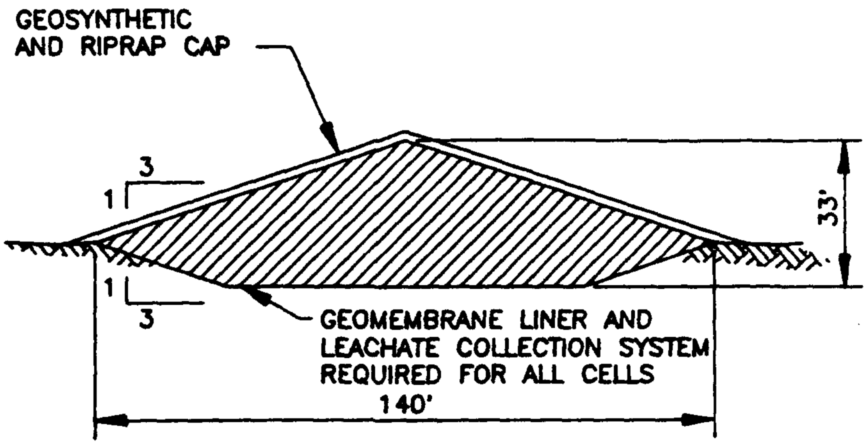
PLAN

8 CELLS 610' BY 45'

Job No. : 22831	BULK CERCLA WASTE MANAGEMENT ASSESSMENT – ALTERNATIVE 3b.1 OUTDOOR WASTE PILE – 8 CELLS
Prepared by : JGA	
Date : 5/15/92	FIG. 3-2

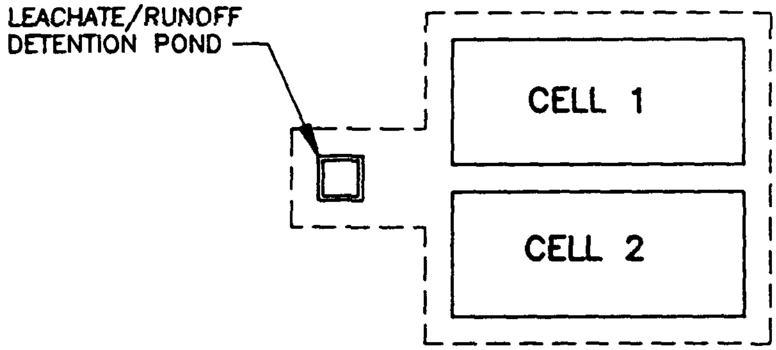
PLOT 1=200

RMOPT3B1



SECTION

SCALE: 1" = 40'



PLAN

2 CELLS 390' BY 140'

Job No. : 22831	BULK CERCLA WASTE MANAGEMENT ASSESSMENT – ALTERNATIVE 3b.2 OUTDOOR WASTE PILE – 2 CELLS
Prepared by : JGA	
Date : 5/15/92	FIG. 3–3

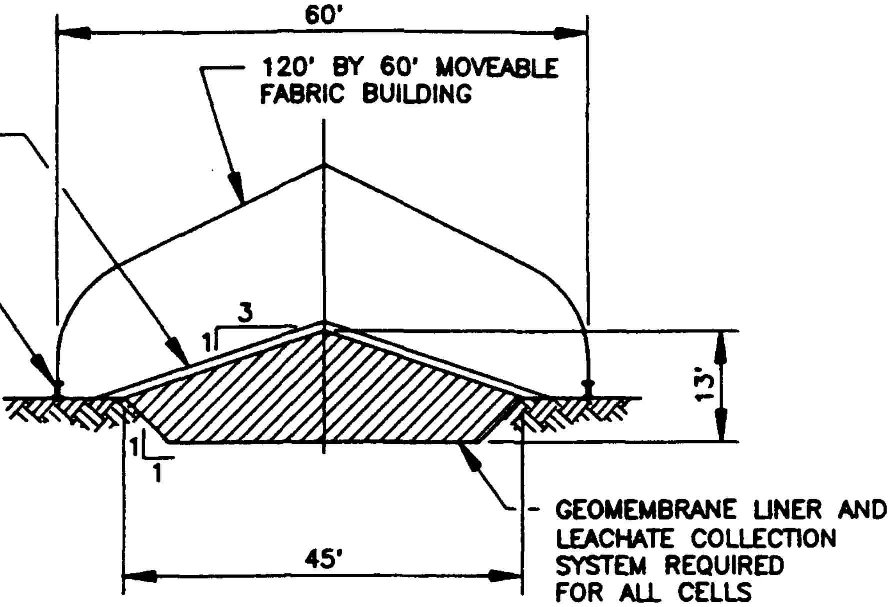
RMOPT3B2 PLOT 1=200

Closure of outdoor waste piles would involve the removal of all wastes and potentially contaminated cap and liner materials as well as removing any underlying soils contaminated by leachate leakage. The potential for contaminating underlying soils is greater for an outdoor pile exposed to precipitation than for an indoor pile, particularly if the wastes are dry, since some liner leakage can generally be expected. Sampling and testing the subgrade after waste removal would be required for confirmation of contaminant removal. After waste removal, site restoration consisting of grading and reseeding would be required to reestablish sufficient surface drainage and vegetation.

3.1.3.3 Alternative 3c - Hybrid Waste Pile

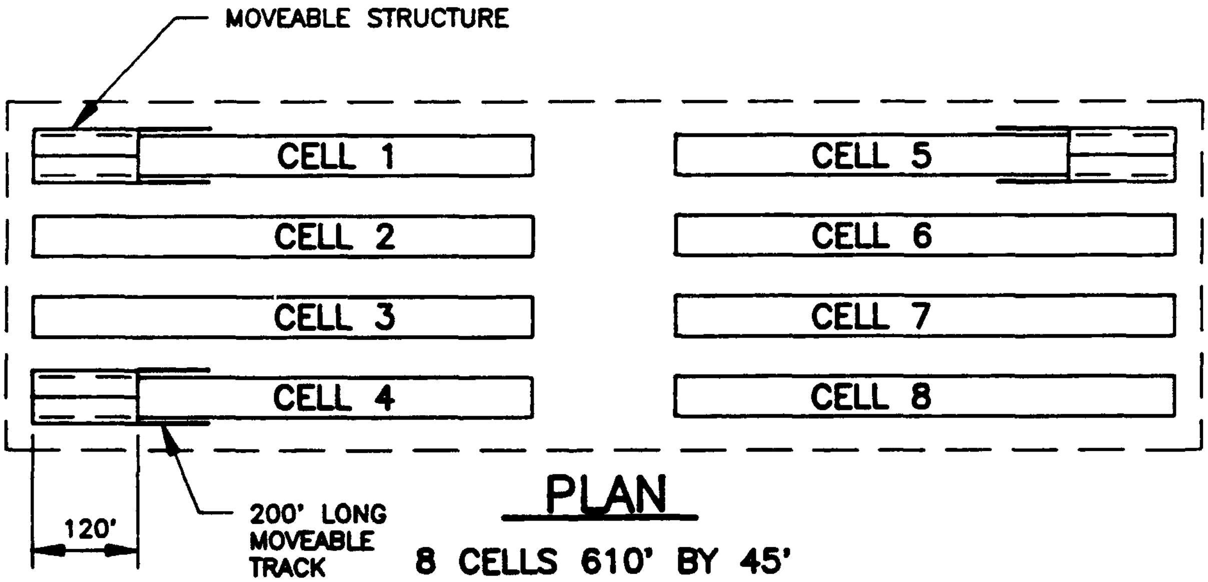
The primary advantage of an indoor waste pile is that precipitation can be kept from contacting the wastes, thereby limiting the amount of leachate and/or contaminated runoff, particularly if the wastes are dry. However, the costs of providing buildings or other structurally supported covers are relatively high. The primary disadvantage of an outdoor waste pile is that large quantities of potentially contaminated leachate and runoff will be generated and liners and leachate collection systems would be required beneath all of the waste. A third alternative for a waste pile that was considered combines the advantages of shelter for an indoor waste pile with the advantage of relatively low cost for an outdoor waste pile. This alternative, referred to in this document as an indoor/outdoor "hybrid" waste pile, would consist of piles placed and capped in cells beneath a movable structure to prevent contact with precipitation and the subsequent generation of potentially contaminated runoff. The cells would be provided with geomembrane liners and leak systems the same as described for outdoor waste piles in Subsection 3.1.3.2. The structures would consist of a 60-foot-wide by 120-foot-long aluminum-frame fabric-covered frame. One to three of these structures would be required, depending on operational requirements. Three structures were used in costing, and would result in a total of 21,600 square feet compared with 230,000 square feet for the buildings described in Alternative 3a. The cells placed in the 60-foot-wide structures would be 45 feet wide and up to 610 feet long. The waste would be placed and capped under the shelter of the movable structure with the same cap detail described for an outdoor waste pile.

A typical pile and structure cross-section and cell layout are shown in Figure 3-4. The structures would be moved along the lengths of the cells on track systems consisting of steel wide-flange sections attached to shallow concrete-drilled pier anchors. The site layout would be very similar to that used for Alternatives 3a and 3b.1. As for alternatives 3a and 3b.1, site grading would provide for a 2 percent slope across the entire site in the longitudinal direction of the cells. During operation, surface drainage of the completed portion of a cell in progress would be off



SECTION

MOVABLE STRUCTURE ON TRACKS
SCALE 1"=20'



PLAN

8 CELLS 610' BY 45'

PLOT 1=200

RMOPT3C

Job No. : 22831	BULK CERCLA WASTE MANAGEMENT ASSESSMENT - ALTERNATIVE 3c HYBRID WASTE PILE
Prepared by : RLB	
Date : 5/15/92	FIG. 3-4

the crowned cap toward swales between cells. Surface drainage of the excavated but unfilled portion of the cell in front of the movable structure would have to be removed by pumping from the low end of the cell. However, this runoff would be uncontaminated and could be discharged into the swale adjacent to the cell. The cell would be constructed and completed in relatively short segments, and the location of a temporary sump would be moved each time the movable structure was moved. Similar to Alternative 3a, a portable ventilation system with a baghouse would be moved along with the operation to control and collect dust.

The primary disadvantage of the hybrid waste pile concept is that the facility would essentially be under construction throughout its operation. This would require that the facility crew be trained in liner installation and performance of the activities required to move the structures.

Placement of the waste in piles beneath the movable structures would be very similar to that described for an indoor waste pile. One or two small front-end loaders would be required to place and compact the wastes. Closure of the waste piles would be similar to closing outdoor waste piles as described in Subsection 3.1.3.2. All wastes and potentially contaminated cap and liner materials would have to be removed and the site restored.

3.1.3.4 Minimal Technology Waste Pile

In order to establish a baseline upon which to evaluate other waste management alternatives, a low cost, minimal technology alternative was developed. This alternative was conceived as one that would incorporate the implementability and cost advantages of a centralized waste management facility located on Site 11, pragmatically address concerns regarding imminent endangerment to human health and the environment (recognizing the existing contamination already present in Section 36), and provide for a short-term (5-year) solution to the waste management requirements, while partially compromising full-compliance with RCRA and other regulatory requirements. It was acknowledged that this alternative would require regulatory consent to waive some of the "engineered design" aspects of the RCRA regulations in order for this alternative to be chosen.

The minimal technology alternative chosen consists of non-RCRA compliant, unlined waste piles located at Site 11 on the south-central border of Section 36. Two large waste piles would be constructed at this location with minimal grading to prepare the site. Each pile would be approximately 400 feet by 150 feet and 25 feet high, with 2:1 side slopes. Once the wastes were in place and compacted, the piles would be covered with plastic covers to control wind dispersal and precipitation infiltration. The plastic would be placed as 10- to 20-foot wide panels rolled

out by hand and held in place by sandbags located every 10 to 20 feet in all directions. Geotextile and 6 inches of crushed rock would be provided in drive areas for trafficability. These accessways would be sloped at 2 percent away from the piles and surrounding fences and at two to 5 percent toward the natural drainage paths contributory to Basin A. A geosynthetic silt fence would be constructed at the north end of the site to catch solids runoff from the piles. Existing upgradient and downgradient wells would be utilized as contaminant migration monitoring wells.

The primary disadvantage of this alternative is lack of positive control of leachate formation and migration. Runon and precipitation infiltration, though reduced by the plastic covers and site grading, would not be eliminated. The potential for leachate formation and contaminated runoff would, therefore, be greater for this alternative than for any of the other alternatives. Offsetting this disadvantage is the fact that the groundwater and much of the soil at this site are known to be contaminated and the additional contaminant contribution from the waste pile leachate and runoff would be inconsequential in the regional view. Basin A and the Basin A Neck groundwater intercept system provide short term contaminant migration control for Section 36 surface and groundwater migration. Final remediation of the Section 36 surface water, groundwater, and soils contamination concerns will be addressed in the final RMA ROD.

3.2 SCREENING OF ALTERNATIVES

3.2.1 Evaluation Process and Ranking Criteria

The alternatives presented in Subsection 3.1 were evaluated using the following five criteria found in the EPA guidance document on RI/FS (EPA 1988):

- Overall protection of human health and the environment
- Compliance with applicable requirements
- Short-term effectiveness
- Implementability
- Cost effectiveness

Other FS evaluation criteria presented in the referenced guidance (e.g., long-term effectiveness) were not used based on the short-term nature of this facility. These other criteria relate to permanent closure and/or remediation.

Protection of human health and the environment addresses how effective the alternatives are at providing adequate protection to human health, both of workers and to the public, and of the environment.

Compliance with applicable requirements relates to how effectively the alternatives meet applicable environmental regulatory requirements.

Short-term effectiveness relates to how effective the alternatives will be in protecting human health and the environment in the short term (i.e., during the construction and implementation period).

Implementability relates to the technical and administrative feasibility of conducting the alternative. It includes the ease of construction and operation of the facility, reliability of the alternative, flexibility of the alternative relating to expansion capacity, the ease of monitoring, and the availability of equipment and specialists.

A qualitative ranking for these first four criteria is presented in Table 3-1 as the technical ranking. The rankings indicate a high, medium, or low ability to satisfy a criterion. A score of 3 indicates high, a score of 2 indicates medium, and a score of 1 indicates low ability to satisfy a criterion. Numerical values were assigned to allow the rankings to be summed. The intent of the technical ranking is to demonstrate the relative advantages and disadvantages between the alternatives.

Cost effectiveness is an assessment of the relative overall value of each alternative. Cost estimates were made, including facility, operating, maintenance, and closure costs, for each of the alternatives. The screening cost estimates were based on vendor information, Means Cost-estimating Guides, and prior similar estimates for landfill and capping projects designed in the region in the past three years as modified by site-specific information. The results of the cost estimates are presented in Table 3-1 in terms of relative costs on a scale of 0 to 3, with a ranking of 3 given to the lowest cost, to allow summation with the technical rankings. The relative cost rankings are valid since consistent unit costs were utilized among the estimates. Comparative costs were based on the use of the same site (Site 1) for consistency.

3.2.2 Evaluation Results

The results of the evaluation of each alternative are summarized in Table 3-1. The following presents a discussion of the evaluation of each alternative.

TABLE 3-1
EVALUATION OF ALTERNATIVES
BULK CERCLA WASTE MANAGEMENT

	ALTERNATIVE 1 OFFSITE DISPOSAL	ALTERNATIVE 2 CONTAINER STORAGE		ALTERNATIVE 3 WASTE PILE				
		(a) DRUMS	(b) ROLL-OFF CONTAINERS	(a) INDOOR	(b) OUTDOOR [1] 8 Cells	(b) OUTDOOR [2] 2 Cells	(c) HYBRID	(d) MINIMAL TECHNOLOGY
PROTECTION OF HUMAN HEALTH & ENVIRONMENT	3	3	3	3	3	3	3	2
COMPLIANCE WITH ARARs	3	3	3	3	2	2	2	1
SHORT TERM EFFECTIVENESS	2	3	3	3	1	1	3	1
IMPLEMENTABILITY	3	1	1	2	2	2	2	2
TECHNICAL RANKING (SUM OF SCORES)	11	10	10	11	8	8	10	6
RELATIVE COST RANKING(1)	0.4(2)	0.2	0.8	1.4	1.6	1.9	1.8	3
OVERALL RANKING (SUM OF SCORES AND COST)	11.4	10.2	10.8	12.4	9.6	9.9	11.8	9

1 - Low ability to satisfy IRA objectives
2 - Medium ability to satisfy IRA objectives
3 - High ability to satisfy IRA objectives

Notes: (1) Cost ranking factors are based on the ratio of the total present value (TPV) of Alternative 3(d) relative to each alternative's TPV
(2) Costs of Alternative 3 are based on Site 1

3.2.2.1 Alternative 1 - Off-Site Disposal

Disposing of bulk CERCLA wastes off site receives a relatively high technical ranking because it is easily implemented, will satisfy applicable requirements, and is protective of human health and the environment. However, it is the only alternative evaluated that poses concerns with long-term effectiveness. Off-site disposal would be permanent and the RMA parties would retain liabilities for wastes disposed off site. Furthermore, short-term effectiveness is a concern in terms of transporting large quantities of waste relatively long distances. This alternative ranks as the second most costly of the alternatives evaluated.

3.2.2.2 Alternative 2 - Container Storage

The two container storage alternatives rank high in terms of protection of human health and the environment, compliance with applicable requirements, and short-term effectiveness. At the end of the waste management period, all of the wastes could be easily removed from the buildings, and the buildings and storage containers disposed of or decontaminated. However, Alternative 2a for storage in drums and Alternative 2b for storage in roll-off containers rank low for implementability due to the level of effort required to store and track the wastes. The cost for managing all of the waste in drums is the highest of all the alternatives. Management of all the waste in roll-off containers is also relatively costly. The cost analysis assumes drums would be disposed with wastes but that all of the large containers would be purchased new and one-third of their value would be recovered after closure of the container storage facility and decontamination of the containers.

3.2.2.3 Alternative 3 - Waste Pile

The indoor waste pile alternative ranks high in terms of protection of human health and the environment, and compliance with applicable requirements. The outdoor waste pile Alternatives 3b and 3c rank moderate for compliance with applicable requirements since regulatory waivers would be required to omit the recently regulated secondary liners and leak detection systems. Both Alternatives 3a and 3c (the indoor alternative and the hybrid alternative) also rank high for short-term effectiveness. Alternative 3b, the outdoor waste pile alternative, ranks low in terms of short-term effectiveness because large quantities of potentially contaminated runoff and leachate would be generated. The advantages of preventing dry wastes from becoming wet are significant. Alternative 3d, the minimal technology alternative, ranked moderate for protection of human health and the environment, and low for compliance with applicable requirements and short-term effectiveness. The waste pile alternatives are all given a medium ranking for

implementability, primarily due to the fact that they all require substantial but manageable effort for construction, operation, and maintenance.

The cost of each of the waste pile alternatives is less than the cost of off-site disposal or container storage. Alternative 3a is the most costly of the waste pile alternatives, primarily due to the high cost of buildings. No salvage value for the buildings was assumed because their future usefulness is not known, and demolition costs could more than offset salvage value. Alternative 3b.2, the 2-cell outdoor waste pile alternative, had the lowest cost. The cost of leachate treatment was estimated by assuming the leachate would be treated only for low-level organic contamination using the carbon-treatment component of the RMA CERCLA Wastewater Treatment Plant. A unit cost was developed based on estimated costs for the additional granular activated carbon that would be required and for a 2-person crew to staff the plant an extra 600 hours annually.

The cost of Alternative 3c, hybrid waste pile, is the second lowest of all the alternatives, and approximately 5 percent higher than Alternative 3b.2. As described in Subsection 4.1.4.3, this alternative has the primary advantage of an indoor waste pile in that precipitation can be kept from contacting the wastes, thereby limiting the amount of leachate and/or contaminated runoff. It also has the advantage that a large square footage of new building is not required. A salvage value of 75 percent of the cost of the aluminum frames was used in the cost estimates.

3.3 SELECTION OF PREFERRED ALTERNATIVE

Based on the alternatives evaluation results presented in Subsection 3.2.2 and the site screening results presented in Subsection 4.4, the preferred bulk CERCLA waste management alternative is Alternative 3c, the hybrid waste pile, located on Site 11 on the south central border of Section 36. This alternative receives the second highest technical ranking with both the container storage alternatives. Only off-site disposal and indoor waste piles had higher technical rankings. Only the indoor waste pile alternative ranked higher overall than the selected alternative because regulatory waivers will be required for Alternative 3c, resulting in a moderate ranking for compliance with applicable requirements. Considering a substantial cost savings estimated for Alternative 3c over Alternative 3a, and since the PMRMA believes the proposed waivers are justified, Alternative 3c constructed on the contaminated Site 11 was selected (see Subsection 4.3).

Considering the approach of constructing the facility on a contaminated site, site grading will be planned to minimize the import of uncontaminated soil fill. The hybrid waste pile will be used to manage bulk soil wastes.

The three alternatives for managing the building debris (off-site disposal, on-site containers and on-site waste pile) are the same as for managing the soil wastes. Management of the debris in lined and capped cells is the least expensive alternative. However, this option approximately doubles the amount of waste placed in the cells because of the need to place a buffer of soil around the waste to protect the liner and cap from being punctured by the debris. Off-site disposal is approximately twice as costly as management of the debris in on-site cells. The management of the debris in containers in existing buildings is between 15 and 20 percent more costly than management in lined cells. However, there is no increase in the volume of waste. Roll-off containers placed in existing buildings will be used to manage the relatively small quantity of building debris to ease the segregation of the waste and to avoid increasing its volume by mixing it with the required cover soil in a waste pile.

The site screening presented in Subsection 4.4 indicates Site 11 is the preferred site. Site 11 is surrounded by areas of significant soil and groundwater contamination and is located well within a large plume of organic groundwater contaminants. Approximately the upper 10 feet of soil above groundwater on the south half of Site 11 may not be contaminated; however, little soil data is available in this area. Considering the chemical characterizations of these sites, Site 11 is the one least likely to be impacted by the facility and would generate the smallest volume of additional waste in the event that leachate leakage occurred.

Any of the buildings discussed in Subsection 4.2, with the exception of the wood-frame 300 series with close column spacings, will be suitable for container storage of potentially contaminated building debris. There is little technical preference for use of any one of these buildings over another, and the selection could be based primarily on future-use plans. However, Buildings 791 through 798 may be preferred because they have already been used for hazardous waste storage, and because the multiple, relatively small buildings provide flexibility regarding the amount of floor space that needs to be dedicated to waste management. The use of these buildings may depend on the timing of new facility construction versus building demolition. Managing potentially contaminated materials in a portion of one of the larger buildings could restrict the usage of the remainder of the building. It is estimated that approximately 50,000 to 60,000 square feet of floor space would be required to manage 5,000 cubic yards of building debris in roll-off or other similar containers stacked two high.

4.0
SITE SELECTION

This section describes the process that was used to select the site on which the bulk CERCLA waste management facility will be constructed. The site selection began with a review of existing information and applicable regulations. Based on this review, eleven sites for new waste pile construction and five existing structures or groups of structures were identified for further screening of the alternatives. The potential sites were then further evaluated to identify three preferred alternative sites and then a selected site for a new facility. All sites with a potential for utilizing existing structures for container storage were retained for further consideration and will be selected in a separate letter implementation document.

The site selected for the new waste pile facility (Site 11) is located in the south central portion of Section 36 on the north side of December 7th Avenue and just west of the Shell Trenches IRA. The site is about 400 feet east-west by 1,300 feet north-south, with about 20 feet of elevation difference between the high south end and low north end. The site slopes down to the north at about 1 percent at the north and south ends and at about 5 percent in the center, averaging approximately 1.5 percent over the entire site. The soils on the site extend to depths of approximately 15 to 25 feet and consist of silty to clayey sands and sandy clays and silts. The surficial soils are underlain by claystones and sandstones of the Denver formation. The depth to groundwater varies from as shallow as 1 to 3 feet at the north end to between 7 and 12 feet on the south portion of the site. Seasonal fluctuations in the groundwater level are typically approximately 3 to 4 feet on the site. The difference between maximum and minimum groundwater level measurements obtained in wells on and adjacent to the site during the past six to seven years range from about 3.5 to 6 feet. A design-level geotechnical engineering investigation of the site, including 8 boreholes, was underway at the time this Decision Document was being prepared. The site is within the Basin A soil contamination site based on the RI Summary Report (Ebasco 1991). The groundwater beneath the site is contaminated with volatile halogenated organic (VHO) compounds, semi-volatile organic compounds including pesticides and sulphur compounds, and dibromochloropropane (DBCP).

4.1 EXISTING INFORMATION REVIEW

Existing RMA site information was reviewed including the Hazardous Waste Land Disposal Facility Assessment document for RMA (Ebasco 1988a), the RMA RI Summary Report (Ebasco 1991), boring logs obtained from the RMA RIC, the RMA Bald Eagle Management

Area (BEMA) maps, Hazardous Wastes in Colorado (CDH 1980), RCRA regulations, and EPA guidance documents.

Information regarding existing conditions at RMA were taken from the RI Summary Report, well logs obtained from the RIC, conversations with RMA personnel, and site visits. The following figures from the RI Summary Report (Ebasco 1991) were used in the site selection and screening process:

- A1.4-3 Alluvial Isopach Map
- A1.5-2 Projected 120-year Floodplain
- A1.5-3 Thickness of the Unsaturated Zone
- A1.5-4 Saturated Thickness of the Unconfined Flow System
- A1.6-2 Bald Eagle Management Area
- A3.1-1 Location of Soil Contaminant Site Types at Rocky Mountain Arsenal
- A3.2-8 Total Organic Analytes in the Unconfined Flow System - 1989

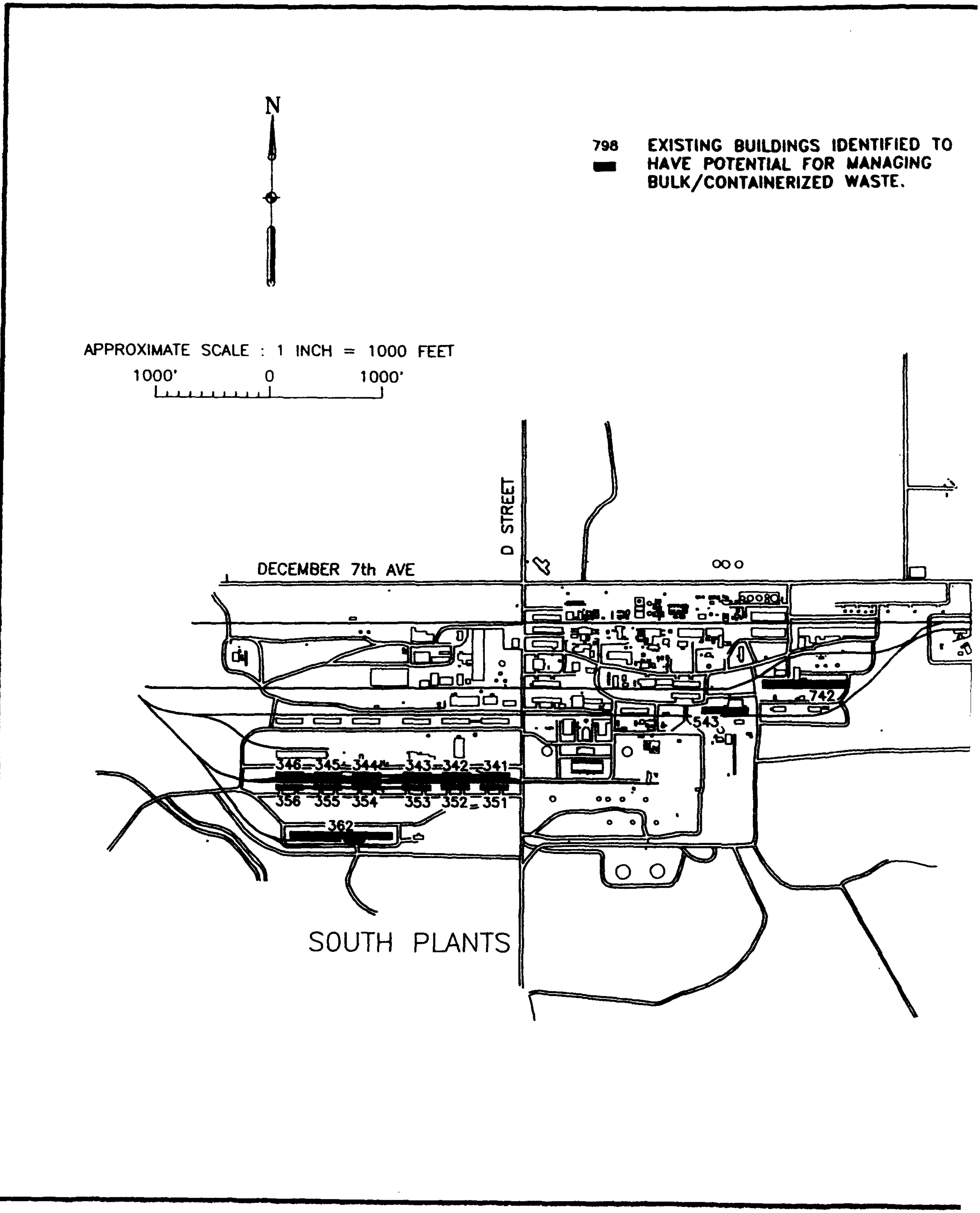
Well logs obtained from the RIC were used in preliminary evaluations of the sites to avoid intrusive field work during the assessment. Topographic maps of the sites were obtained and site visits were made to further assess the current condition of the sites (e.g., have there been any changes in the land use or new buildings?).

Information on existing buildings was obtained from the Structures Survey Report (Ebasco 1988b), building observations, and conversations with PMRMA personnel. The Structures Survey report included brief histories, current use, sizes, and planned future use of the buildings.

4.2 RECONNAISSANCE OF EXISTING BUILDINGS FOR CONTAINER STORAGE

Several buildings in the South Plants area were observed and evaluated for potential use as bulk or containerized storage areas. These buildings were selected for reconnaissance based on their distance from the RMA boundary, their warehouse-type construction, apparent floor area available for container storage, and accessibility. Five buildings or groups of buildings were identified for potential use as bulk or container management facilities, as described below. Locations of the buildings are shown in Figure 4-1.

Information on the history of these structures is presented in the Structures Survey Report (Ebasco 1988b). Most of these buildings have potentially been exposed to a variety of hazardous materials at some time; however, all of the buildings evaluated have been used for



N
798 EXISTING BUILDINGS IDENTIFIED TO HAVE POTENTIAL FOR MANAGING BULK/CONTAINERIZED WASTE.
APPROXIMATE SCALE : 1 INCH = 1000 FEET
1000' 0 1000'
D STREET
DECEMBER 7th AVE
742
543
346 345 344 343 342 341
356 355 354 353 352 351
362
SOUTH PLANTS

T09-FIG

; IDENTIFIED TO
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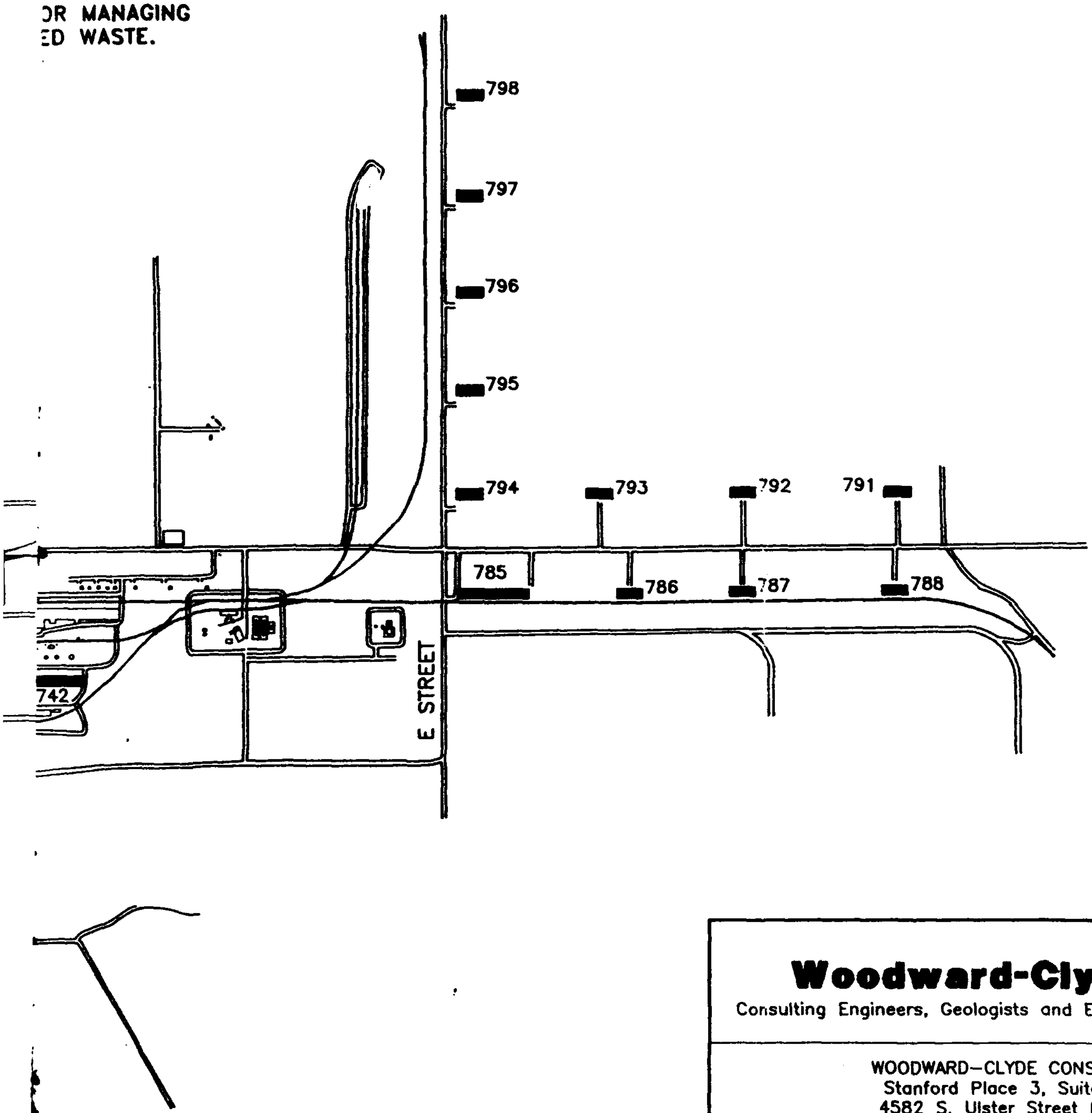

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LOCATION OF BUILDINGS
BULK CERCLA WASTE MANAGEMENT
ROCKY MOUNTAIN ARSENAL

FIGURE NO. 4–1

non-hazardous office and warehouse activities in the past 10 to 20 years. No contamination-related health and safety precautions were required for the reconnaissance. The following buildings were observed:

Building 362

Building 362, located near the southwest corner of the South Plants, is presently being used as a warehouse. It is approximately 60 feet wide and 900 feet long. The building is divided into four equal sections separated by fire walls and double fire doors. The building is constructed of concrete masonry units and steel trusses spanning the full width of the building. The trusses are approximately 14 feet above the concrete floor. Three of the four bays are clear open floor space. The fourth bay is clear for two-thirds of the space, with offices, locker rooms, and the boiler room occupying the remaining one-third. The occupied space is constructed of masonry walls and would not be readily usable without some demolition. This leaves 49,500 square feet of the total 54,000 square feet readily usable.

The building presently is heated and working lights are mounted in the trusses. Potable water and sanitary sewer service in the building will be removed by September of 1992. The principle access to the building is through multiple 10-foot by 10-foot doors along the north and south sides of the building. Between many of the larger doors are single- or double-wide man doors. All doors on the north side of the building access truck loading docks at slab elevation. All doors on the south side of the building access rail docks at slab elevation. The exterior grade is 3 to 5 feet below the floor level and there is no drive-in access into the building.

Building 543

Building 543 is presently being used for the RMA facility maintenance shop. The building is approximately 80 feet wide and 395 feet long and is located near the center of the east side of the South Plants. Like Building 362, Building 543 is a masonry structure with steel trusses spanning the full width of the structure. The building is divided in half by a masonry fire wall and small office area. A 10-foot by 10-foot access exists between the two halves. The east half of the building has good access through a large drive-in door on the east wall. The only access to the outside from the west half of the building is through an overhead door accessing a rail dock on the south side of the building. This is a heated building with potable water and sanitary sewer presently

servicing it. These services will be removed by September of 1992. Most of the approximately 32,000 square feet of floor space could readily be utilized if the building were vacated.

Building 742

Building 742, located immediately northeast of Building 543, is being used to store vehicles and sand for winter road maintenance. The building is divided into three sections. The east and west sections are generally open space with some smaller rooms divided off. The center section is open with abandoned in-ground concrete tanks and trenches in the floor slab. The center section is not readily usable without additional demolition and reconstruction of a floor slab. The building has brick walls with 66-foot-long wood trusses spanning the full width of the building. The total length of the building is 741 feet, with the middle section shorter than the two end sections. Masonry fire walls divide the three sections. Both end sections are accessed by twelve-foot-high overhead doors in the east and west ends of the building. Of the approximate 49,000 square feet of total space, the amount of readily usable space is 33,000 square feet. All utilities to this building will be removed by September of 1992.

Buildings 785 through 798

Buildings 785 through 798 are located along 7th Avenue and E Street north and east of their intersection. Eleven of these 12 buildings are 60 feet wide and 160 feet long. Building 785 is 60 feet wide and 480 feet long. These buildings are constructed with concrete masonry unit walls and full-width steel trusses fourteen feet above a slab on grade. Typically, each of the smaller buildings has two 12-foot-high overhead doors near both ends of one of the long walls. Each of the 11 buildings has approximately 9,600 square feet of open floor space, totaling approximately 105,000 square feet. Building 785 is approximately 29,000 square feet resulting in approximately 134,000 square feet for all 12 buildings. The eleven smaller buildings are currently being used as warehouses for storage of drums containing hazardous materials and for storage of contractor's equipment and supplies. Building 785 is being used as an initial staging area for drums containing potential hazardous waste before being placed in storage. No utilities service these buildings.

Buildings 341 through 346 and 351 through 356

Eleven of these 12 buildings are similar in size and construction. All that remains of Building 353 is the foundation. These buildings are of wood frame construction, 46 feet wide and 240 feet long. Interior columns are approximately 15 feet on center in both directions. Access to the buildings is through 10-foot by 10-foot doors along both sides of the buildings. Typically, one side of the building has a continuous rail dock and the other side has a series of truck docks. The condition of the buildings vary. The roofs and walls of some of the buildings need repairs to make them weather tight. Others are in reasonably good repair. Of the twelve buildings (132,480 square feet), one is being used, all that remains of another is the foundation, and 10 are vacant. The 10 available buildings result in a total floor area of about 111,000 square feet. A building closure project was recently completed for this group of buildings. This work involved cleaning the insides of loose debris, boarding up windows, and bolting shut access doors. Used these buildings as container storage facilities would require undoing the building closure work.

All of the buildings described above could potentially be used for management of small containers (i.e., drums) and all of the buildings except the 300-series buildings (with 15-foot column spacings) could be used for management of waste in large containers. Therefore, approximately 270,000 square feet appear to be available for large container storage.

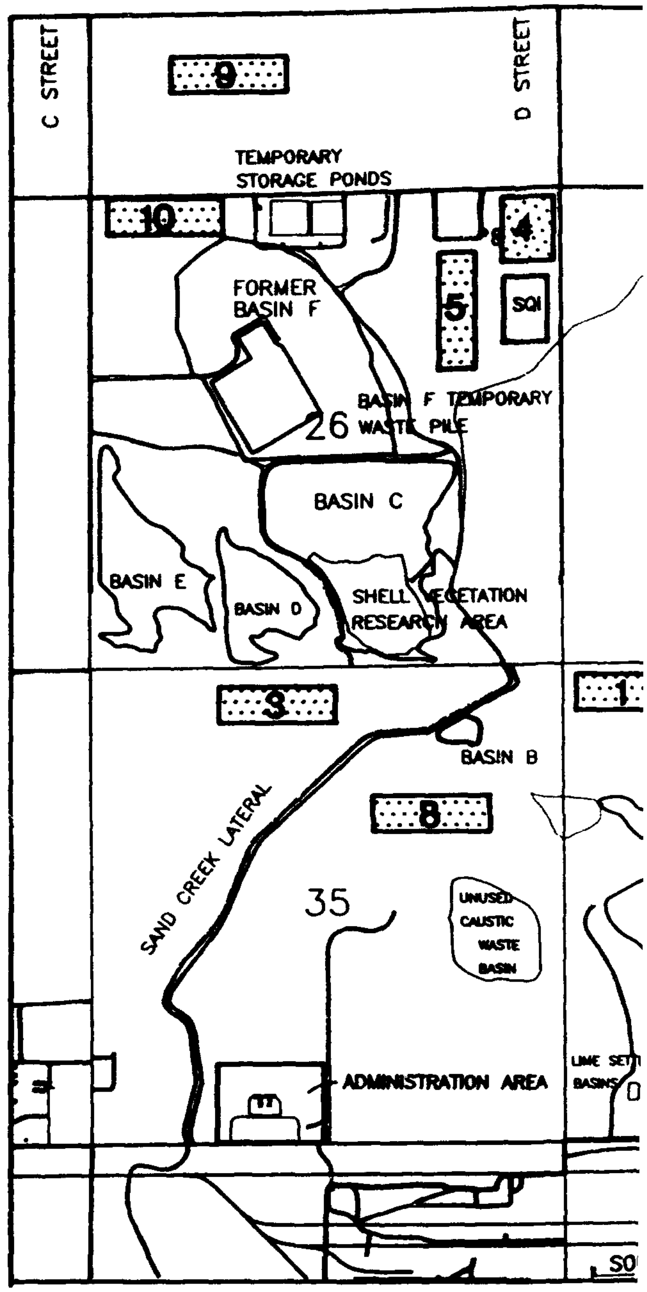
Of the 270,000 square feet potentially usable for container storage, most of this space could be conveniently used for managing roll-off or other similar containers stacked two high. The buildings all have either dock-height or grade-level doors of sufficient size for trucks and/or roll-off containers. The volume of waste that could be stored in piles in existing buildings would be limited by the 12- to 14-foot-high trusses.

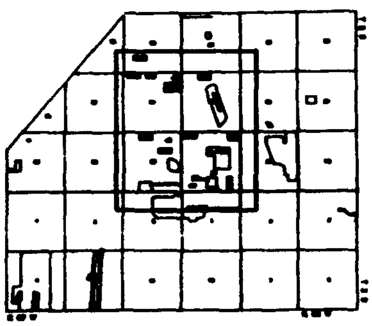
4.3 SITE SCREENING CRITERIA

The initial site locations for new facilities were selected based on the criteria listed in Table 4-1. This table provides comments on the sources of the criteria and reasons for use. These six criteria were used to select the 11 potential sites shown in Figure 4-2. The site selection criteria are discussed further below.

TABLE 4-1
INITIAL SITE SELECTION CRITERIA

Criterion	Regulation or Reference	Comment
200 feet from Holocene Fault	40 CFR 264.18 (a)	RCRA location requirement
100-year Floodplain	40 CFR 264.18(b)	RCRA location requirement
½ mile to RMA boundary	PMRMA requirement	
Avoidance areas	USATHAMA 1984	Avoid dedicated land use and highly contaminated areas
BEMA	Endangered Species Act - 16 USC 1531 et. seq.	Bald Eagle Management Area (BEMA) would have restricted use during part of the year
10 Acres or larger	Not applicable	Minimum operational size for desired capacity





LOCATION MAP

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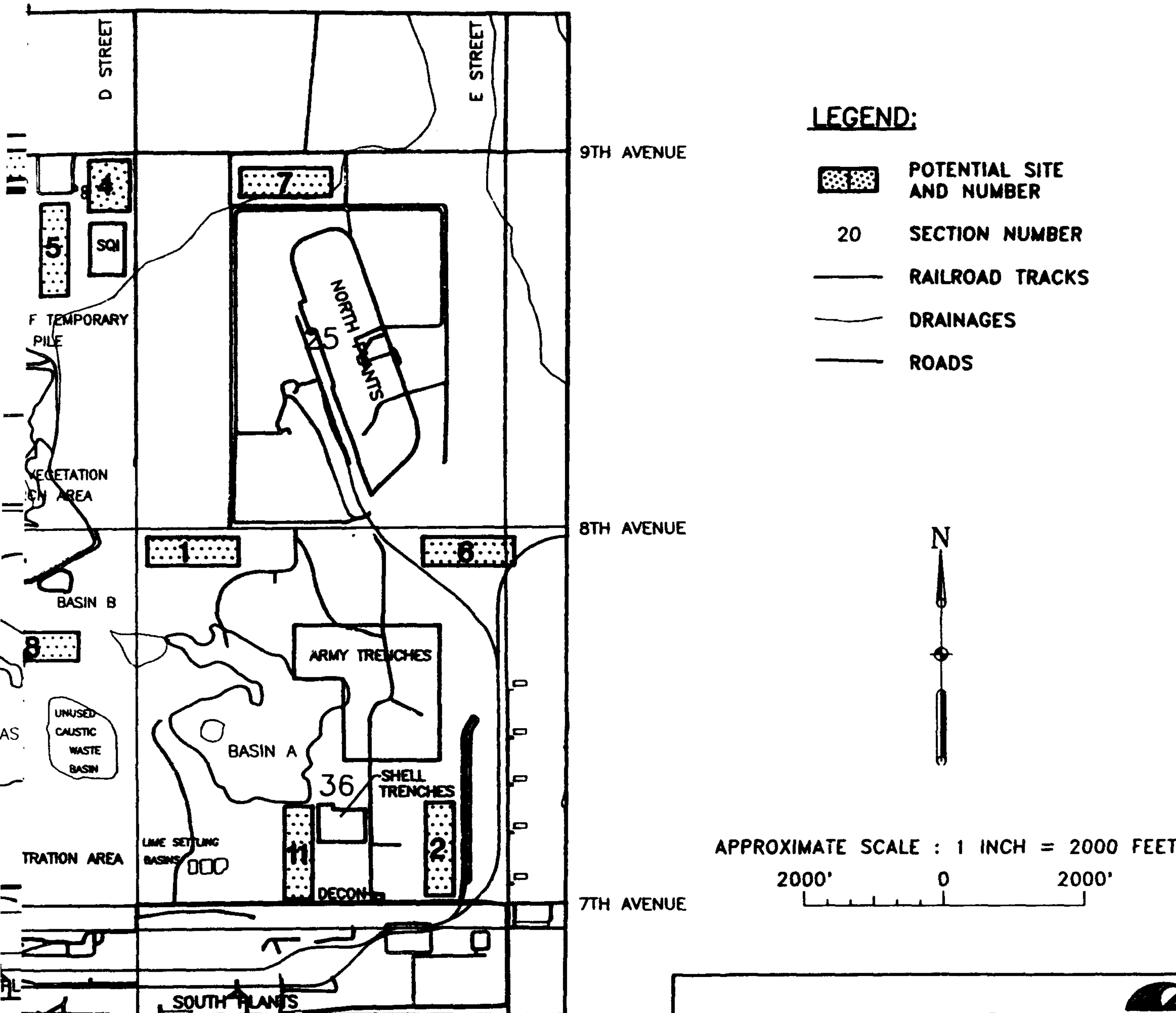

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LOCATION OF POTENTIAL SITES
BULK CERCLA WASTE MANAGEMENT
ROCKY MOUNTAIN ARSENAL

FIGURE NO. 4–2

The minimum distance from Holocene fault movement is discussed in the Hazardous Waste Land Disposal Facility Assessment document (Ebasco 1988a). The Derby Fault, which crosses under RMA, has experienced movement in the recent past, and is discussed in detail in the Hazardous Waste Land Disposal Facility Assessment Document. To summarize, the ground surface is more than 200 feet above the Derby Fault so its presence does not represent a siting restriction since the federal and state regulations do not distinguish between horizontal and vertical distance.

The 100-year floodplain map from the RI Summary Report was used as an exclusion area (i.e., no site was allowed to be within the 100-year floodplain) in the initial site screening. None of the sites shown in Figure 4-2 are located within the 100-year floodplain. PMRMA requires that no sites be located within 1/2 mile of the RMA property boundary. This is an increase over the 1,000-foot minimum based on state noise abatement statutes and equipment noise levels used in the land disposal assessment.

Avoidance areas include the administration area, South Plants, North Plants, the boundary water treatment systems, the former Basins A-F, the SQI site, the Basin F waste pile, temporary storage ponds and tanks, the Shell Trenches IRA and the Army Complex Disposal Trenches, and other areas shown on Figure A3.1-1 of the RI summary report titled, "Location of Soil Contaminant Site Types at Rocky Mountain Arsenal," except where only wind-blown contamination exists. The Bald Eagle Management Area (BEMA) was also used as an exclusion area to avoid possible shut downs of the facility during parts of the year. A minimum site size of 10 acres was used early in the assessment. The selected alternative requires nearly 12 acres (400 feet by 1300 feet) and the size criterion was increased accordingly once this was known.

Eleven potential sites that meet the initial siting criteria shown in Table 4-1 were selected. The potential sites were then screened to identify the selected site. The screening was based on the criteria in Table 4-2.

As discussed in Sections 2.0, 3.0, and 4.0 of this Decision Document, the selected alternative is not in complete substantive conformance with the RCRA design requirements promulgated in the January 29, 1992 Final Rule for Liners and Leak Detection Systems for Hazardous Waste Land Disposal Units, in that it will not be provided with a secondary liner and leak detection system. As such, a contaminated site is preferred for the facility in the event that the primary liner and leachate collection system are not entirely effective. The reason for preferring a contaminated site is that, even though the quantity of contaminants beneath the facility could

TABLE 4-2
SITE SCREENING CRITERIA

Criterion	Description
Presence of contaminated soil/groundwater	To justify waiver of requirements for secondary liner and leachate collection system
Impact on wildlife	Should be kept to a minimum based on discussions with USF&W
Distance to roads/utilities	Includes roads, electric power and water
Site topography	Gently sloping topography is preferred to limit site grading quantities
Visibility	Minimize visual impact on RMA neighbors
Interference with existing operations	Interference with operations of other facilities or IRAs should be avoided

be increased, the volume of contaminated soil and groundwater requiring remediation would, theoretically, not be increased.

The U.S. Fish and Wildlife Service (USF&W) was asked for input into the site screening process with respect to impact on wildlife. Their preference of sites was Sites 1, 2 and 11, then 4 and 5. USF&W would prefer the following sites not be used: Sites 9 and 10 because of burrowing owl nesting sites in the area and deer use; Site 3 because of heavy year round deer use and good forage; and Site 6 because of its proximity to bald eagle feeding areas.

Site conditions, such as topography, will affect both the construction of the facility and its operation. A relatively flat site with 2 to 3 percent slopes is preferred because it could easily be graded for drainage and access with a minimum of cut and fill. Drainages and gullies across a site indicate a potential for increased erosion and increased management of runon and runoff, as well as increased site grading quantities.

Minimizing the visual impact of the facility during its lifetime is an issue primarily for neighbors on the west and north sides of RMA. With this in mind, visibility from offpost should be minimized.

Interference with existing operations is a concern because it could cause conflicts between the operation of the new and existing facilities and possibly affect access to one of the facilities. These interferences could negatively impact operations at one or both of the facilities.

4.4 SITE SCREENING AND SELECTION

Screening of the 11 potential sites was performed by assigning each site from 0 to 4 points for each criterion described above. The points are high when the conditions at the site are favorable and low when they are not. Each criterion was also assigned a multiplier between 1 and 3 based on its importance relative to the other criteria.

Table 4-3 presents the rankings of the sites and multipliers for the criteria used in the site screening. The three highest ranking sites in order are 11, 1, and 2. Site 11 is located in the south central portion of Section 36 just south of Basin A and just west of Shell Trenches; Site 1 is located at the northwest corner of Section 36 on the southeast corner of 8th Avenue and D Street; and Site 2 is located in the southeast portion of Section 36 just east of the decontamination pad. Site 1 is underlain by approximately 15 feet to over 30 feet of uncontaminated soils overlying contaminated groundwater near the edge of a large plume of organic contaminants. Site 2 probably has some surface soil contamination, but is underlain largely by uncontaminated soils and uncontaminated groundwater. Site 11 is surrounded by areas of significant soil and groundwater contamination and is located well within a large groundwater plume of organic contaminants. Approximately the upper 10 feet of soil above groundwater on the south half of Site 11 may not be contaminated; however, little soil data is available for this area.

Considering the chemical characterizations of these sites, Site 11 is the one least likely to be impacted by the facility and would generate the smallest volume of additional waste in the event that leachate leakage occurred. Therefore, implementation of final design and construction of the facility will proceed on Site 11.

TABLE 4-3
SITE SCREENING CRITERIA AND RANKING

SITE	Mult	1	2	3	4	5	6	7	8	9	10	11
Contaminated Soil	3	2.0	2.0	0.0	2.0	2.0	0.0	0.0	0.0	1.0	2.0	3.0
Contaminated Groundwater	3	4.0	1.0	2.0	2.0	4.0	0.0	2.0	2.0	2.0	2.0	4.0
Wildlife Impact	3	4.0	4.0	0.0	3.0	3.0	0.0	1.0	2.0	0.0	0.0	4.0
Distance to Elec	1	4.0	4.0	2.0	4.0	4.0	2.0	2.0	2.0	1.0	1.0	4.0
Distance to Water	1	4.0	4.0	2.0	4.0	2.0	2.0	2.0	2.0	1.0	1.0	4.0
Distance to Roads	1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	4.0
Topography	2	0.1	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	4.0	3.0
Visibility	2	4.0	4.0	4.0	2.0	2.0	4.0	2.0	3.0	1.0	1.0	4.0
Interference	2	4.0	2.0	4.0	0.0	0.0	4.0	4.0	4.0	4.0	3.0	4.0
TOTALS		60	53	34	41	45	28	33	32	29	34	67

5.0 DESCRIPTION OF SELECTED ALTERNATIVE

As discussed in Subsection 3.3, the selected alternative will consist of alternative 3c, the indoor/outdoor hybrid waste pile, located on Site 11 in the south central portion of Section 36. However, the facility described in Subsections 3.1.4.3 and 3.2.2.3 involved constructing waste piles to accept approximately 65,000 cubic yards of bulk soil wastes. Considering the revised reduced estimates of waste volume and the uncertainty of the total volume of wastes summarized in Table 2-1, design and construction of the facility will be conducted in phases. Appendix A presents preliminary design drawings for Phase I of the facility, which will be designed to accommodate 30,000 cubic yards of waste soil. If required by the identification of other waste sources, Phase II of the facility will be located north of Phase I, as shown on Sheet 2. Phase II could also be extended to the west to incorporate a third phase that would more than double the size of the facility originally constructed for Phase I. Approximately 5,000 cubic yards of building debris will be managed in roll-off containers in existing buildings. The preliminary design presented in the decision document and the implementation document for Element 3 of the additional actions under the pretreatment of CERCLA Liquid Waste IRA will address design and construction of the waste pile facility. Container storage in buildings will be addressed in a letter implementation document similar to those issued for Elements 1 and 2 of the additional action under the CERCLA Liquid Waste IRA.

Sheets 3 and 4 in Appendix A show the site grading that will be required for construction of Phase I. Because of the requirement for a 2 percent slope the length of the waste pile cells, the entire site will be graded at 2 percent down to the north. This will result in fill depths of up to about 5 feet on the south portion of the site. Some excavation will be required below the existing ground surface elevation, particularly in the cell areas toward the north. It is desired to plan the site grading so there will be no excess cut or fill. However, the groundwater elevations on the site combined with the project design criterion requiring the placement of the cell bottoms at least 5 feet above the seasonal high groundwater levels result in a requirement for the net import of approximately 11,000 cubic yards of fill material. This soil will be obtained from an uncontaminated on-post borrow source. All fill placed during site grading will be compacted according to generally accepted earthwork specifications. If Phase II is constructed, the fill import volumes will be greater than for Phase I because of the shallower groundwater conditions on the north portion of the site. The existing piles of rubble and soil on the south portion of the site, and any excess excavated soils, will be stockpiled toward the southern end of the Phase II area during Phase I construction and operations.

A geotechnical engineering investigation was in progress at the time of the preparation of this draft Decision/Preliminary Design Document. The subsoils found in the exploratory borings encountered primarily loose to medium dense silty to clayey sands. Loose soils and shallow groundwater were encountered in the Phase II area. Site grading will have to be conducted according to a health and safety plan that addresses the potential contamination on the site. Site grading operations will be conducted above groundwater, so the contaminated groundwater that has been identified beneath the site will not affect site grading.

Sheets 5 and 6 in Appendix A show details of the proposed cell lining and cap systems and moveable structures. As discussed earlier in this document, only a single liner and leachate collection system will be provided in the cells.

Sheet 7 shows an operational plan describing the sequence of operations that will be used. The cells will be filled from upslope to downslope, or south to north. Approximately the south 1/3 of the covered area beneath the structure is where final grading and placement of the cap geomembrane and riprap cap will take place. Placement and general grading of the waste will occur with small earth moving equipment in the central portion of the covered area, and waste placement and liner installation will occur in the north portion of the covered area. The moveable structure will be moved in increments of approximately 1/3 of its length. Prior to moving the structure, the capped area at the south end will have to be completed. Immediately after moving the structure, a new segment of the liner system will be constructed and the temporary sump moved to the downgradient end of the new covered location. The leachate collection laterals will be left in place to serve as collection laterals in the final leachate collection system. Once a cell is completed, a semi-permanent sump will be constructed at the downgradient end of each cell. Since none of the waste will be exposed to precipitation, leachate volumes are anticipated to be small. Initially, leachate removal will be conducted as necessary using portable pumps and truck or trailer-mounted tankers. Dedicated pumps and semi-permanent leachate storage tanks may be installed at the downgradient ends of the cells if warranted by the rate of leachate generation.

As discussed in subsection 3.1.4.2, closure of the waste piles will involve the removal of all wastes and potentially contaminated cap and liner materials, as well as removing any underlying soils contaminated by leachate leakage. Sampling and testing the subgrade after waste removal will be required for confirmation of contaminant removal. After waste removal, site restoration consisting of grading and reseeding will be required to establish sufficient surface drainage and vegetation.

6.0
CHRONOLOGY OF EVENTS

The significant events pertaining to Element 3 of the CERCLA Hazardous Waste Interim *Response Action* are presented below:

Date	Event
June 1987	State of Colorado, Shell Oil Company, U.S. Environmental Protection Agency and the U.S. Army agreed that certain Interim Response Actions would be conducted.
February 1988	Proposed Consent Decree (1988) lodged in the case of U.S. v. Shell Oil Company with U.S. District Court in Denver, Colorado. The Consent Decree specified 13 interim actions, including this IRA, to facilitate remediation activities.
February 1989	Federal Facility Agreement signed.
June 1991	CERCLA Wastewater Treatment Plant Final Implementation Document issued.
January 1992	Technical study document prepared by the Army describing the *addendum* to the CERCLA Liquid Waste IRA. Three additional elements of the CERCLA Hazardous Waste IRA were proposed.
May 1992	Draft Decision/Preliminary Design Document issued for Element 3 of the CERCLA Hazardous Waste IRA, Bulk CERCLA Waste Management.

7.0
IRA PROCESS

With respect to this additional action under the CERCLA Liquid Waste IRA, the IRA process is as follows:

1. Within 20 days after issuance of the draft Decision/Preliminary Design Document for Element 3 of the CERCLA Hazardous Waste IRA, an organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the Federal Facility Agreement, or DOI under the circumstances set forth in the Federal Facility Agreement) may invoke Dispute Resolution.

2. After the close of the period for invoking Dispute Resolution (if Dispute Resolution is not invoked) or after the completion of Dispute Resolution (if invoked), the Army shall issue a draft Final Decision Document for Element 3 of the CERCLA Hazardous Waste IRA with the supporting administrative record. Thereafter, the Decision Document will be subject to judicial review in accordance with Sections 113 and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. Sections 9613, 9621.

3. Following issuance of the Final Decision/Preliminary Design Document, the United States Army shall be the Lead Party responsible for designing and implementing the IRA additional element in conformance with the Decision/Preliminary Design Document. The Army shall issue a draft Implementation Document to the DOI, the State, and the other organizations for review and comment. This draft Implementation Document shall include final drawings and specifications, final design analyses, a cost estimate, and a schedule for implementation of the IRA element.

4. As Lead Party for design and implementation of this IRA element, the Army will issue the final Implementation Document, as described above, and will be responsible for implementing the IRA element in accordance with the Implementation Document.

The Superfund Amendments and Reauthorization Act (SARA) requires that any hazardous substance or pollutant remaining at a site listed on the National Priority List (NPL) meet the level or standard of control established by applicable or relevant and appropriate regulations (ARARs), standards, requirements, criteria, or limitations established under any federal environmental law or more stringent standards, requirements, criteria, or limitation promulgated pursuant to a state environmental statute.

As amended by SARA, Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) further provides that under certain circumstances an ARAR may be waived. These waivers apply only to meeting ARARs with respect to remedial actions on-site; other statutory requirements, such as the requirement that remedies be protective of human health and the environment, cannot be waived.

CERCLA Section 121(d)(4)(A) provides a waiver from ARARs for interim response actions (IRAs) stating that an interim remedial action is not required to attain the same level or standard of control as required for final actions. This waiver is applicable to interim action measures that are not intended to be permanent remedial solutions. Since the Bulk CERCLA Waste Management facility is an interim response action, compliance with ARARs is not required under CERCLA. Although CERCLA does exempt interim response actions from meeting ARARS, the Federal Facilities Agreement requires that IRAs shall, to the maximum extent practicable, attain ARARs.

8.1 DEFINITION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A requirement may be either applicable or relevant and appropriate to remedial activities at a site, but not necessarily both. Applicable requirements are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site. A remedial action must satisfy all the jurisdictional prerequisites of a requirement for the requirement to be applicable.

If a regulation is not applicable, it may still be relevant and appropriate. Relevant and appropriate requirements mean those clean-up standards, standards of control, and other substantive environmental protection requirements and/or criteria promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site.

Non-promulgated advisories or guidance documents issued by federal or state governments do not have the status of potential ARARs. However, these advisories and guidance are to be considered (TBC) when determining protective clean-up levels.

8.2 TYPES OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs have been divided into three major categories: chemical-specific requirements, location-specific requirements, and action-specific requirements.

Chemical-specific requirements are based on health or risk-based concentration limits or discharge limitations in environmental media such as air or water, for specific hazardous chemicals. These requirements may be used to set clean-up levels for the chemicals of concern in the designated media, or to set a safe level of discharge (e.g., air emissions or wastewater discharge taking into account water quality standards) when a discharge is required during the remedial activity.

Location-specific ARARs are restrictions placed on the types of activities that may occur in particular locations. The location of a site may be an important characteristic in determining its impact on human health and the environment, and thus states may have established location-specific ARARs. Other location-specific ARARs include federal requirements for wetland protection, the seismic design considerations of RCRA, and flood plain restrictions on management of hazardous waste.

Action-specific requirements generally set performance, design, or other similar operations controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements address the particular activities that are selected to accomplish a remedy. There are a number of alternative remedial actions considered for this site, and there may be several action-specific requirements for each alternative. These action-

specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be designed, operated, or managed.

8.3 CHEMICAL-SPECIFIC ARARS

Chemical specific ARARs have not been developed for this document as this is a temporary facility and the final disposition of the contaminated soils will not be determined until the Record of Decision is issued.

8.4 LOCATION-SPECIFIC ARARS

A site's location is a fundamental determinant of its impact on human health and the environment. For this reason, several environmental regulations limit any type of development or waste management activities in sensitive areas. The following location-specific regulations were found to be either applicable or relevant and appropriate requirements (ARARs) for this IRA:

RCRA Location Requirements - RCRA Section 3004(o)(7)

RCRA contains a number of explicit limitations on where on-site storage, treatment, or disposal of hazardous waste may occur. In accordance with 40 CFR 264.18(a), new treatment, storage or disposal of hazardous waste is prohibited within 200 feet of a fault that experienced displacement in Holocene time. Similarly, 40 CFR 264.18(b) limits the placement of a hazardous waste treatment, storage, or disposal facility within a 100-year floodplain unless the facility was designed, constructed, operated, and maintained to avoid washouts. Finally, 40 CFR 264.18(c) prohibits the placement of non-containerized or bulk liquid hazardous waste within salt dome formations, underground mines or caves.

Endangered Species Act - 16 USC 1531 et seq.

The Endangered Species Act is applicable to the siting of the management facility due to the presence of listed endangered species, such as the Bald Eagle, at the Rocky Mountain Arsenal. The Act requires that action be taken to avoid jeopardizing the continued existence of listed endangered or threatened species and to avoid jeopardizing the species' habitat areas.

Section 7(a) of the Endangered Species Act requires federal agencies, in consultation with the Department of Interior (DOI) and the National Marine Fisheries Service (NMFS), as

appropriate, to ensure the actions they authorize, fund or carry out are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their critical habitats.

Substantive compliance with the Endangered Species Act means that the lead agency must identify whether a threatened or endangered species, or its critical habitat, will be affected by a proposed response action. If a response action has the potential to adversely impact endangered or threatened species or its habitat, then action must be avoided or appropriate mitigation measures must be taken so the action does not affect the species or its critical habitat.

Protection of Floodplains - 40 CFR 6, Appendix A

The Protection of Floodplains regulates actions that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland waters and other flood-prone areas. This regulation requires actions that avoid adverse effects and minimize potential harm to the floodplain. This regulation would be applicable if the management facility is located in an area designated as a floodplain.

8.5 ACTION-SPECIFIC ARARS

This section identifies the requirements of 40 CFR 264 that will serve as ARARs and which will be incorporated into the design of the management facility.

8.5.1 Container Storage Area

One of the design options for the management facility is a container or drum storage area. The RCRA regulations define containers as any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled. If this type of facility is constructed, the design and operating requirements of 40 CFR Part 264 Subpart I will be addressed. The design requirements are summarized below, and the operation requirements are described in Section 8.5.1.2

8.5.1.1 Design Requirements

There are two different design configurations for a container storage area: one configuration requires a containment system, the other configuration does not require this containment

configuration. The characteristics of the waste that is to be stored in the facility dictate which design configuration is selected.

A container storage area is not required to have a containment system if the following two conditions are met:

The waste (other than F-listed dioxin wastes) contains no free liquids.

The area is designed and operated to drain and remove precipitation, or the containers are protected from contact with accumulated precipitation.

Free liquids are defined in the regulations as any liquids which readily separate from the solid portion of a waste under ambient temperature and pressure. The paint filter liquids test, as outlined in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, is the method used to evaluate whether free liquids are present.

If the above two conditions cannot be met, the following design requirements must be incorporated into the container storage facility.

The container storage areas must have a containment system that can contain 10 percent of the volume of containers or the volume of the largest container, whichever is greater.

This containment system must have a base sufficiently impervious to contain leaks and spills until the release is detected and removed.

The containment system must be designed and operated to drain and remove liquids, or the containers must be protected from contact with liquids.

The containment system must be designed to prevent run-on or to contain run-on.

Two additional requirements that must be included into both design configurations are listed below:

Containers holding ignitable or reactive waste must be at least 50 feet from the facility's property line.

Hazardous waste containers must be separated from units storing substances incompatible with the waste, using berms, dikes, walls or other devices.

8.5.1.2 Operating Requirements

If a container storage area is used to manage the CERCLA waste, the following operating standards must be addressed:

The containers holding hazardous waste must be in good condition (no rusting or structural defects).

The container and its liner must be constructed of materials that are compatible with the types of waste being stored.

Containers holding hazardous waste must always be closed during storage, except when waste is being removed or emptied from the container.

Containers holding hazardous waste must be opened, handled, and stored in a manner which eliminates leaks or ruptures from the container.

The container storage area must be inspected weekly. The inspections should be developed to identify the following conditions: leaking or deteriorating containers, or deteriorating leak detection system.

8.5.2 Waste Pile

The second design option being considered for the management facility is a waste pile. If this type of facility is constructed, the design and operating requirements of 40 CFR Part 264 Subpart L will be addressed. These regulations were revised and promulgated on January 29, 1992. These design requirements are summarized below, and the operating requirements are described in section 8.5.

There are two general design configurations for a waste pile: one configuration requires the use of two or more liners and leachate collection and removal systems above and between such liners, and implementation of the groundwater monitoring requirements of 40 CFR Part 264 Subpart F; the other configuration, for dry wastes placed in buildings, does not require two or more liners, leachate collection and removal systems, nor compliance with 40 CFR Part 264

Subpart F. There are specific requirements that dictate when each of the design configurations can be used.

8.5.2.1 Design Criteria

If the waste pile is located inside or under a structure that provides protection from precipitation so that neither run-off nor leachate is generated, then the liners and leachate collection and removal systems identified above, and the groundwater monitoring requirements of Subpart F are not required, provided all the following conditions are met:

Liquids or materials containing free liquids are not placed in the pile.

The pile is protected from surface water run-on by the structure or in some other manner.

The pile is designed and operated to control dispersal of the waste by wind, where necessary, by means other than wetting.

The pile will not generate leachate through decomposition or other reactions.

If the above identified conditions cannot be met, the waste pile must be designed with a liner leachate collection and removal systems. The following section outlines the specific design criteria that must be met. If a liner system is required, it must include the following two components:

1) A top liner designed and constructed of materials to prevent the migration of hazardous constituents into the liner during active life and post-closure care.

2) A composite bottom liner with at least two components. The upper component must be designed and constructed to prevent the migration of hazardous constituents into the liner during active life and post-closure care.

Leachate collection and removal systems must be installed immediately above the top liner and between the liners immediately above the bottom liner.

The leachate collection and removal system immediately above the top liner must be designed, constructed, operated, and maintained to collect and remove leachate from the waste pile during the active life and post-closure care period. In addition, the system must be constructed of

materials that are chemically resistant to the waste being managed and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under pressure exerted by overlying wastes, cover material and equipment.

The leachate collection and removal system between the liners functions as a leak detection system. This leak detection system must be capable of detecting, collecting, and removing leaks of hazardous constituents at the earliest practicable time through all areas of the top liner likely to be exposed to waste or leachate during the active life and post-closure care period. The requirements for leachate collection systems are satisfied by installation of systems that are, at a minimum:

1) Constructed with a bottom slope of 1 percent or more.

2) Constructed of granular drainage materials with a hydraulic conductivity of 1×10^{-2} cm/sec or more and a thickness of 12 inches (30.5 cm) or more; or constructed of synthetic or geonet drainage materials with a transmissivity of 2×10^{-5} m^2/sec or more.

3) Constructed of materials that are chemically resistant to the waste managed in the waste pile and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and equipment used at the waste pile.

4) Designed and operated to minimize clogging during the active life and post-closure care period.

5) Constructed with sumps and liquid removal methods (e.g., pumps) of sufficient size to collect and remove liquids and to prevent liquids from backing up into the drainage layer. Each unit must have its own sump(s). The design of each sump and removal system must provide a method for measuring and recording the volume of liquids present in the sump and of liquid removed.

An action leakage rate for waste piles subject to 40 CFR 264.251(c) or (d) must be established. The action leakage rate is the maximum design flow rate that the leak detection system (LDS) can remove without the fluid head on the bottom liner exceeding 1 foot. The action leakage rate must include an adequate safety margin to allow for uncertainties in the design (e.g., slope, hydraulic conductivity, thickness of drainage material), construction, operation, and location of the LDS, waste and leachate characteristics, likelihood and amounts of other sources of liquids

in the LDS, and proposed response actions (e.g., the action leakage rate must consider decreases in the flow capacity of the system over time resulting from siltation and clogging, rib layover and creep of synthetic components of the system, overburden pressures, etc).

Unless the Regional Administrator approves a different calculation, the average daily flow rate for each sump must be calculated weekly during the active life and closure period. To determine if the action leakage rate has been exceeded, the owner or operator must convert the weekly flow rate from the monitoring data obtained under 40 CFR 264.254(c) to an average daily flow rate (gallons per acre per day) for each sump.

A run-on control system capable of preventing flow onto the active portion of the pile during peak discharge from at least a 24-hour, 25-year storm must be designed, constructed, operated and maintained.

A run-off management system to collect and control at least the water volume resulting from a 24-hour, 25-year storm must be designed, constructed, operated and maintained.

Collection and holding facilities (e.g., tanks or basins) associated with run-on and run-off control systems must be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.

If the pile contains any particulate matter which may be subject to wind dispersal, the owner or operator must cover or otherwise manage the pile to control wind dispersal.

A final requirement for both types of waste pile design configurations is that a pile of hazardous waste that is incompatible with any waste or other materials stored nearby in containers, piles, open tanks, or surface impoundments must be separated from the other materials, or protected from them by means of a dike, berm, wall or other device.

8.5.2.2 Operating Requirements

If a waste pile is used to manage the CERCLA wastes, the following operating requirements must be addressed:

When in operation, the waste pile must be inspected weekly and after storms to detect evidence of deterioration, malfunctions, or improper run-on and run-off control systems; proper

functioning of the wind dispersal control systems, where present; and the presence of leachate in and proper functioning of leachate collection and removal systems, where present.

During construction or installation, liners (except in the case of existing portions of piles exempt from 40 CFR 264.251(a)) and cover systems (e.g., membranes, sheets, or coatings) must be inspected for uniformity, damage, and imperfections (e.g., holes, cracks, thin spots, or foreign materials). Immediately after construction or installation:

(1) Synthetic liners and covers must be inspected to ensure tight seams and joints and the absence of tears, punctures, or blisters; and

(2) Soil-based and admixed liners and covers must be inspected for imperfections including lenses, cracks, channels, root holes, or other structural non-uniformities that may cause an increase in the permeability of the liner or cover.

Ignitable or reactive waste must not be placed in a waste pile unless the waste and waste pile satisfy all applicable requirements of the land disposal restrictions (40 CFR 268). The waste must also be treated or mixed before or immediately after placement in the pile so that the resulting mixture is no longer ignitable or reactive.

The waste should be handled in accordance with 40 CFR 264.17(b) which outlines handling procedures for ignitable and reactive wastes.

Hazardous waste must not be piled on the same base as incompatible wastes or materials were previously piles, unless the base has been decontaminated sufficiently to ensure compliance with Section 264.17(b).

Incompatible wastes, or incompatible wastes and materials must not be placed in the same pile, unless Section 264.17(b) is complied with.

A leak detection system 40 CFR 264.251(c) must record the amount of liquids removed from each leak detection system sump at least once each week during the active life and closure period. A response action plan is required for waste piles subject to § 264.251(c) or (d). The requirements of this plan are identified in 40 CFR 264.253. This plan describes the procedures to implement if the action leakage rate is exceeded.

8.5.3 Closure Requirements

Since the intent of this facility is to temporarily store the CERCLA waste until the ROD identifies the final disposition of the waste, the unit will be closed in accordance with 40 CFR Part 264 Subpart G - Closure and Post-Closure. At this time, it is anticipated that all waste, waste residues, liner, etc. will be removed at closure so there will be no need for Post-Closure.

In addition to 40 CFR 264 Subpart G, the facility will be closed in accordance with either 40 CFR 264.178 (requirements for closure of container storage area) or 40 CFR 264.258 (requirements for closure of waste piles). The exact requirements for closure will depend on whether a container storage area or a waste pile is constructed to manage these wastes.

8.5.4 Land Disposal Restrictions

RCRA also places restrictions on the storage of hazardous waste that is subject to the land disposal restrictions (40 CFR 268.50). The regulations require that the generator store waste subject to the land disposal restrictions in tanks or containers on-site solely for the purpose of the accumulation of such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal. RCRA requires a waiver be obtained from the EPA in order for land ban wastes to be stored in a waste pile. Although the wastes to be placed in the facility are not sufficiently characterized to know whether or not any of them will be subject to the land disposal restrictions, it is assumed that some of them will be. Therefore, a waiver from the requirements of 40 CFR 268.50 will be requested by the Army so that the waste can be stored in waste pile rather than in a tank or container.

Another issue that is pertinent to the application of the land disposal restrictions is discussed in the National Contingency Plan (NCP). The NCP discusses when a CERCLA action constitutes "land disposal," which is defined as placement into land disposal units under section 3004(K) of RCRA. This definition is critical because several significant requirements are triggered when placement occurs onto a land disposal unit. One requirement that is triggered when placement occurs is the land disposal restrictions (LDR). The NCP equates an area of contamination (AOC) to a single RCRA land disposal unit and states that movement within the unit does not constitute placement. The NCP also states that placement occurs when waste is redeposited after treatment in a separate unit or when waste is moved from one AOC to another. Placement does not occur when waste is consolidated within an AOC, when it is treated in situ, or when it is left in place.

EPA uses the term AOC to define an area that is delineated by the areal extent of contiguous contamination (EPA, Office of Solid Waste and Emergency Response, Superfund LDR Guide #5, Determining When Land Disposal Restrictions (LDRs) Are Applicable to CERCLA Response Actions, OSWER Directive 9347.3-05FS, July 1989; and the NCP 55 FR 8758, March 8, 1990) (EPA1989b, NCP1990). Consistent with this guidance, the Army has determined that RMA is one AOC. This AOC includes the North Plants, South Plants, and all of the contaminated portions of RMA because all contamination is a result of operations of those plants. The guidance states that the type and concentration of hazardous substance can vary within the AOC, which is the case at RMA. Therefore, since RMA is defined as one AOC, movement of waste within the site does not trigger the requirements of the land disposal restriction.

9.0 CONSISTENCY WITH FINAL REMEDIAL ACTION

The purpose of this additional action under the CERCLA Hazardous Waste IRA is to provide a temporary management facility during interim response actions until a final response action has been selected. Since bulk CERCLA waste management will involve only moving and temporary storage of waste, this additional action will be consistent with and contribute to the efficient performance of final response actions throughout the remainder of the remedial action process at RMA. Use of the facility during final remediation will be addressed in the ROD.

10.0
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BULK CERCL
MANAGEMENT
DRAFT PRELIMINARY DES

ROCKY MOUNTAI
COMMERCE CITY,

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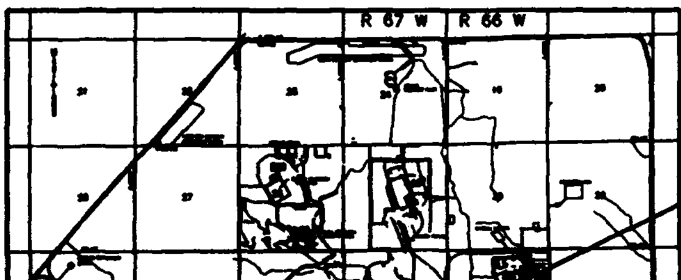
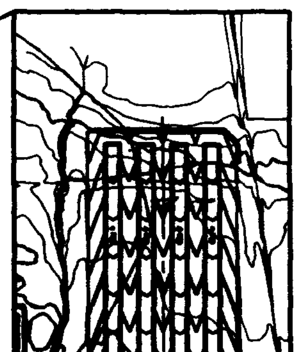


KEY MAP



LOCATION PLAN

:RCLA WASTE
-MENT FACILITY
;INARY DESIGN DRAWINGS

)UNTAIN ARSENAL
:E CITY, COLORADO

MAY 15, 1992

LOCATION PLAN

SHEET TITLE	DRAWING NUMBER
1. COVER SHEET AND DRAWING INDEX	THIS SHEET
2. PROJECT LAYOUT PLAN	09-02-001
3. GRADING PLAN	09-02-002
4. CELL PROFILE AND SECTIONS	09-02-003
5. CELL DETAILS	09-02-004
6. STRUCTURE DETAILS	09-02-005
7. OPERATION PLAN	09-02-006

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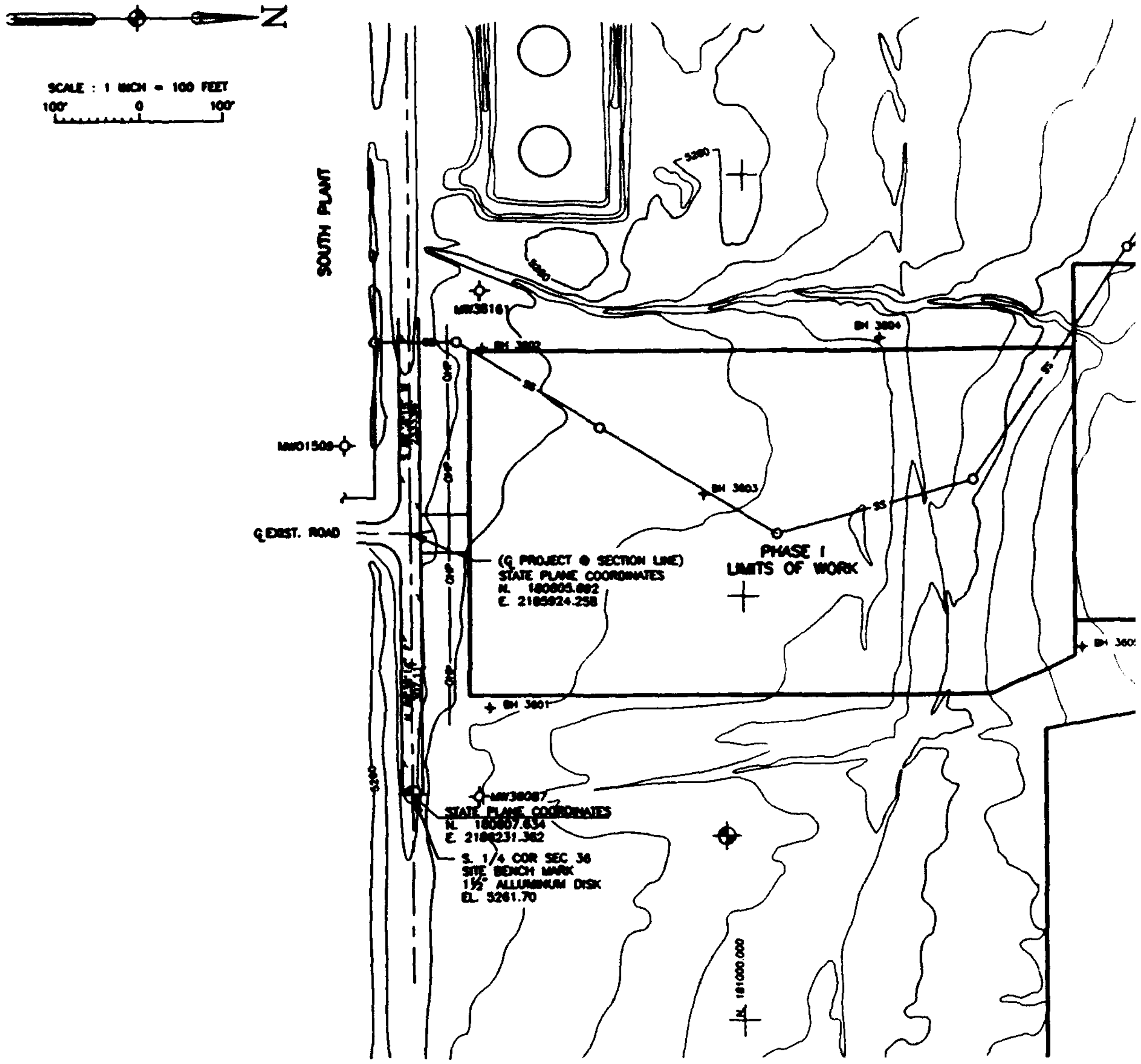
09-02-001



PROJECT LAYOUT PLAN

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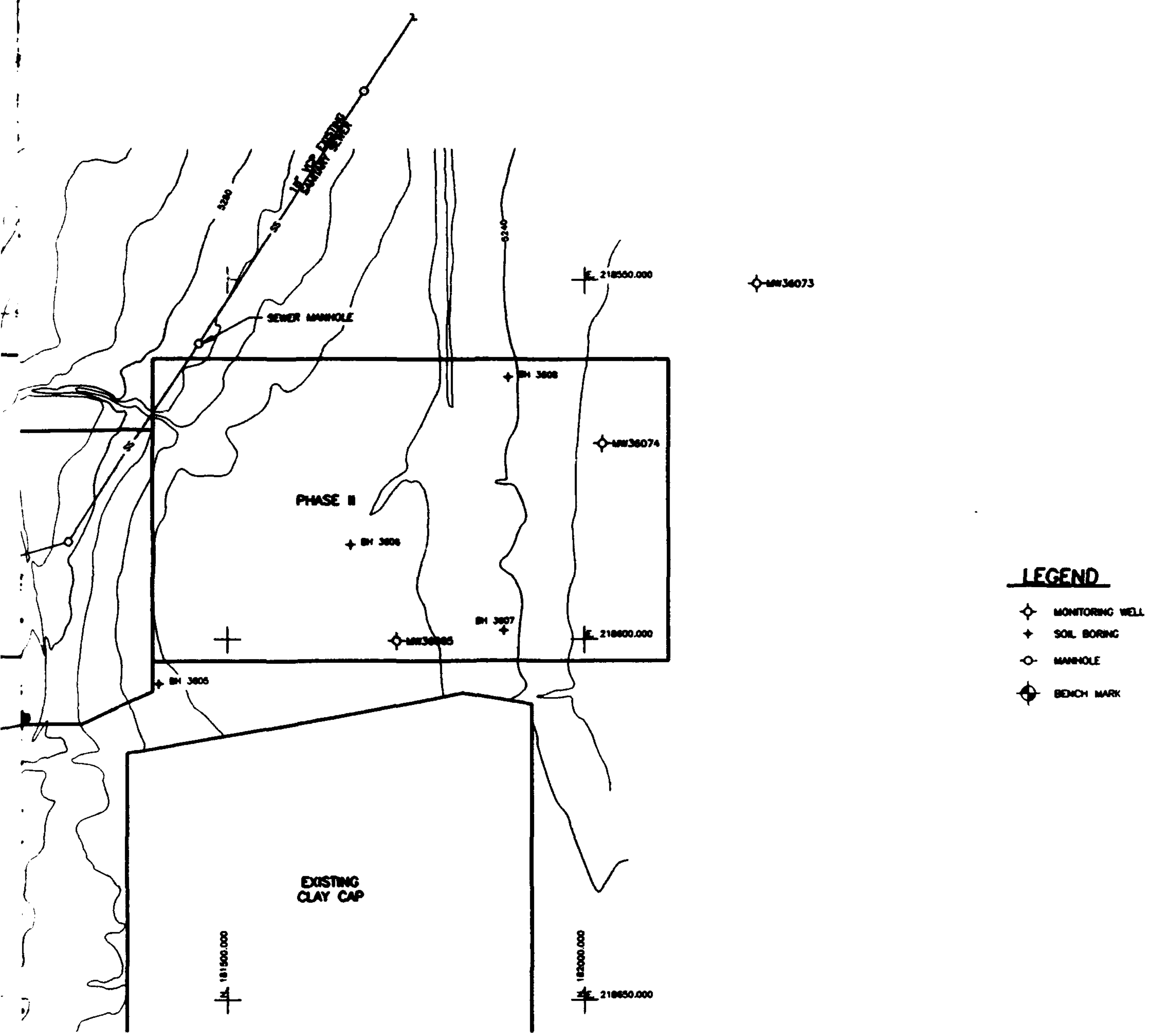

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Consulting Engineers, Geologists and Environmental Scientists

Woodward-Clyde Consultants
Stanford Place 3, Suite 1200
4582 S.Ulster Street Parkway
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A	DRAFT PRELIMINARY DESIGN (OAS REVIEW)	05/15/92
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SCALE	1"=100'
DESIGN	MTZ
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CHECK	RJD
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DATE	03/23/92

CLIENT : ROCKY MTN. ARSENAL
LOCATION : COMMERCE CITY, COLORADO

PROJECT LAYOUT PLAN
SHEET 2 OF 7

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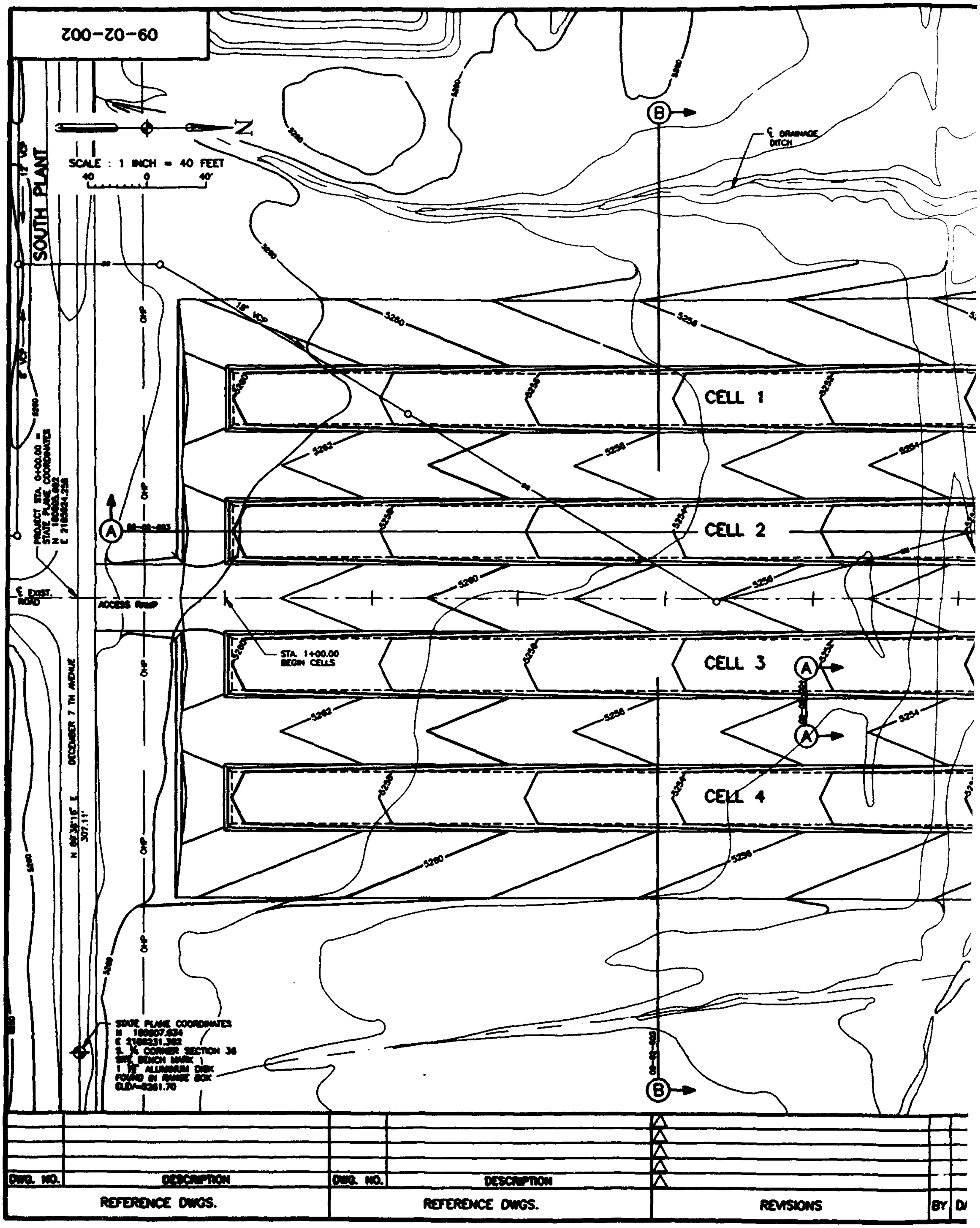
09-02-002
SOUTH PLANT
SCALE : 1 INCH = 40 FEET
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℄ DRAINAGE DITCH
CELL 1
CELL 2
CELL 3
CELL 4
℄ EXIST. ROAD
ACCESS RAMP
STA. 1+00.00 BEGIN CELLS
OHP
DECEMBER 7 TH AVENUE
STATE PLANE COORDINATES
CORNER SECTION 36
FOUND IN RANGE BOX
DWG. NO.
DESCRIPTION
REFERENCE DWGS.
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REVISIONS
BY

LEGEND

-o- MANHOLE

NOTE:

PROPOSED CONTOURS INSIDE CELL INDICATE GRADES PRIOR TO WASTE PLACEMENT.

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Consulting Engineers, Geologists and Environmental Scientists

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SCALE	1"=40'
DESIGN	MTZ
DRAWN	RLB
CHECK	RJD
APP.	
DATE	04/01/92

CLIENT : ROCKY MTN. ARSENAL
LOCATION : COMMERCE CITY, COLORADO

GRADING PLAN
SHEET 3 OF 7

CONTRACT NO.	OWNER NO.	DRAWING NO.	REV. NO.
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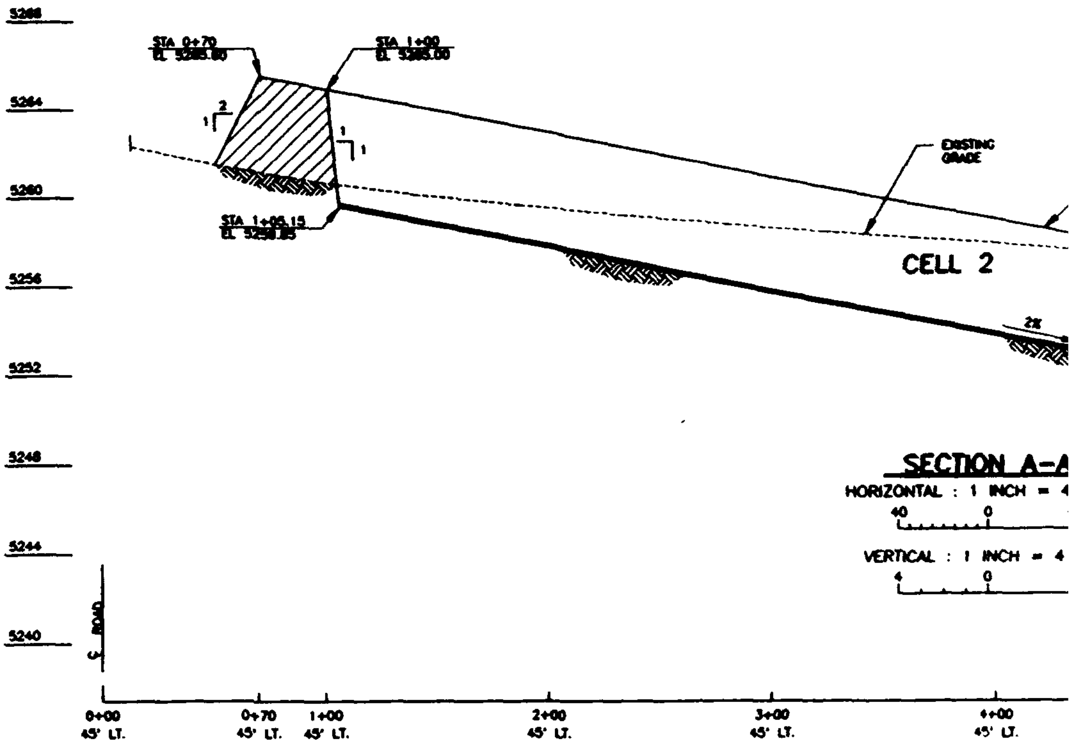
09-02-003



SECTION A-A

HORIZONTAL : 1 INCH = 4

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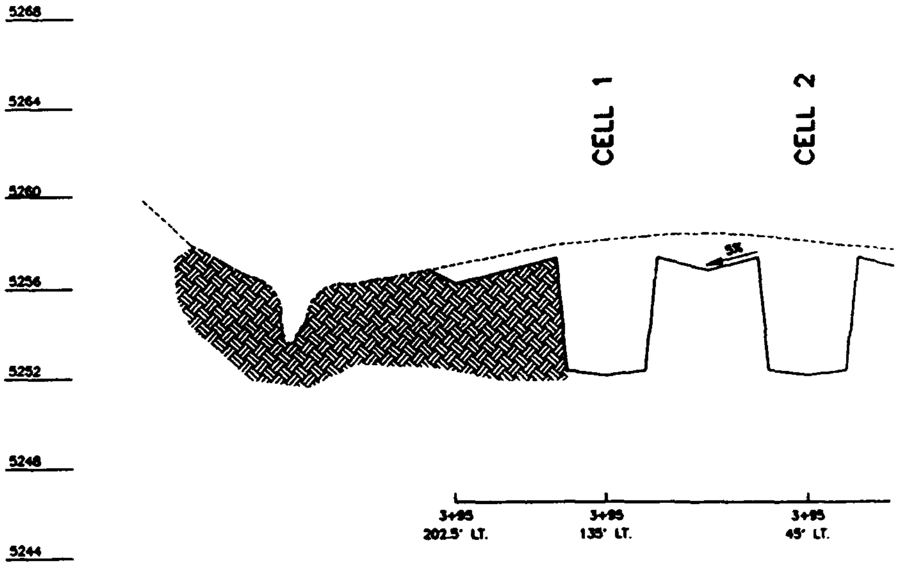
VERTICAL : 1 INCH = 4

4 0



SECTION B

HORIZONTAL : 1 INCH =

40 0

VERTICAL : 1 INCH =

4 0

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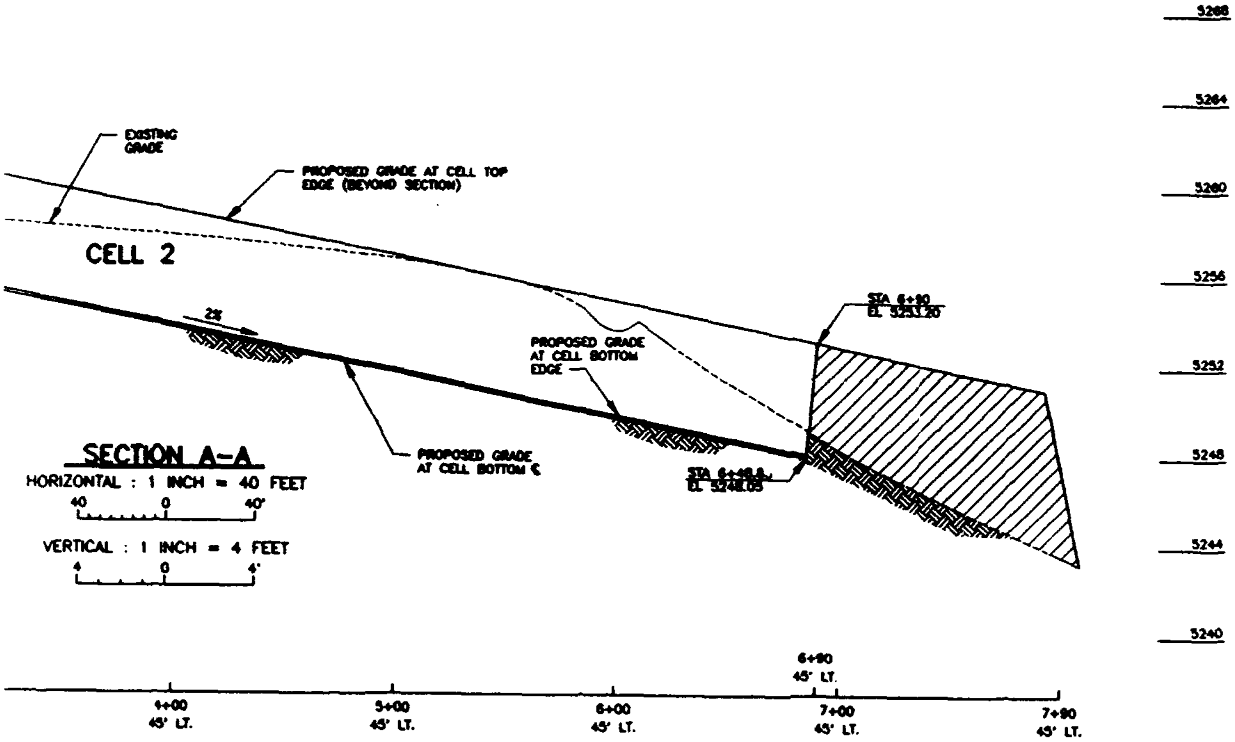

SECTION A–A

HORIZONTAL : 1 INCH = 40 FEET
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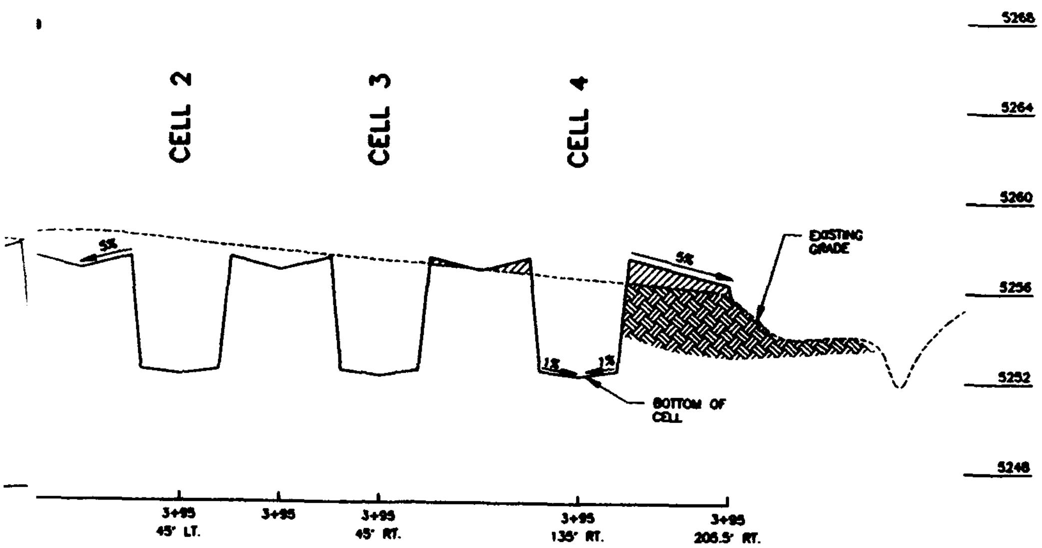
VERTICAL : 1 INCH = 4 FEET
4 0 4'

LEGEND

FILL MATERIAL

EXISTING SOIL



SECTION B–B

HORIZONTAL : 1 INCH = 40 FEET
40 0 40'

VERTICAL : 1 INCH = 4 FEET
4 0 4'

DRAWING REDUCED 50%

	BY	DATE	REVISIONS	BY	DATE	DISTRIBUTION
			DRAFT PRELIMINARY DESIGN (OAS REVIEW)		05/15/92	
			DRAFT PRELIMINARY DESIGN		04/22/92	

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Denver, Colorado 80237

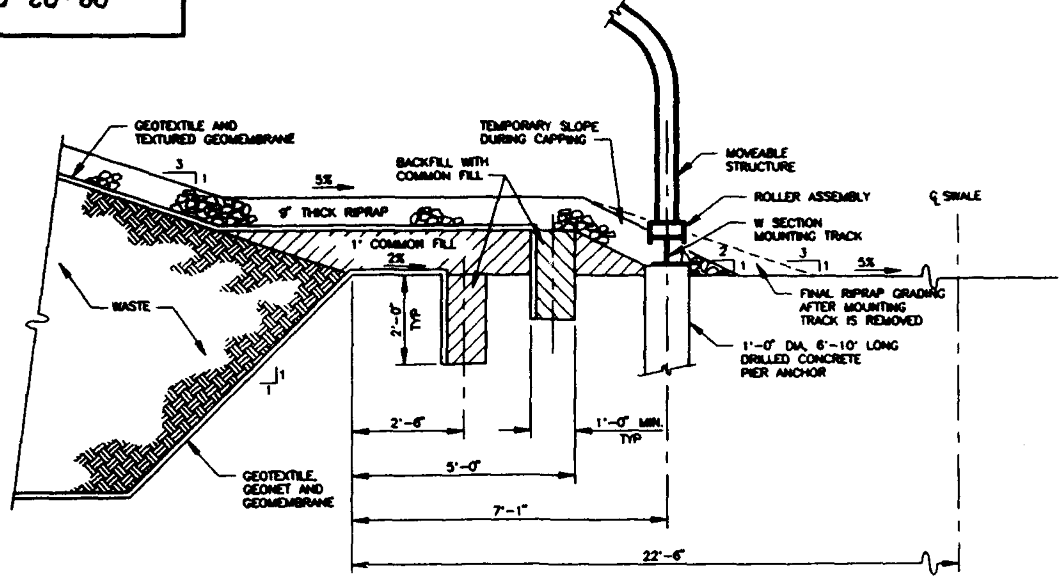
SCALE	AS SHOWN
DESIGN	MTZ
DRAWN	RLB
CHECK	RJD
APP.	
DATE	04/07/92

CLIENT : ROCKY MTN. ARSENAL
LOCATION : DENVER, COLORADO

**CELL PROFILE AND SECTIONS
SHEET 4 OF 7**

CONTRACT NO.	OWNER NO.	DRAWING NO.	REV. NO.
22831	N/A	09-02-003	C

09-02-004

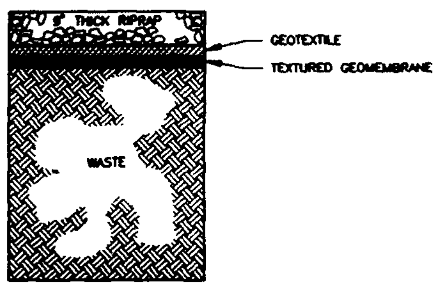


SECTION A

(GEOSYNTHETIC THICKNESSES NTS)

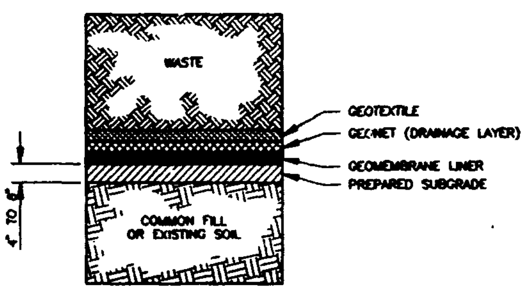
SCALE : ½ INCH = 1 FOOT

12" 0 1' 2' 3' 4'



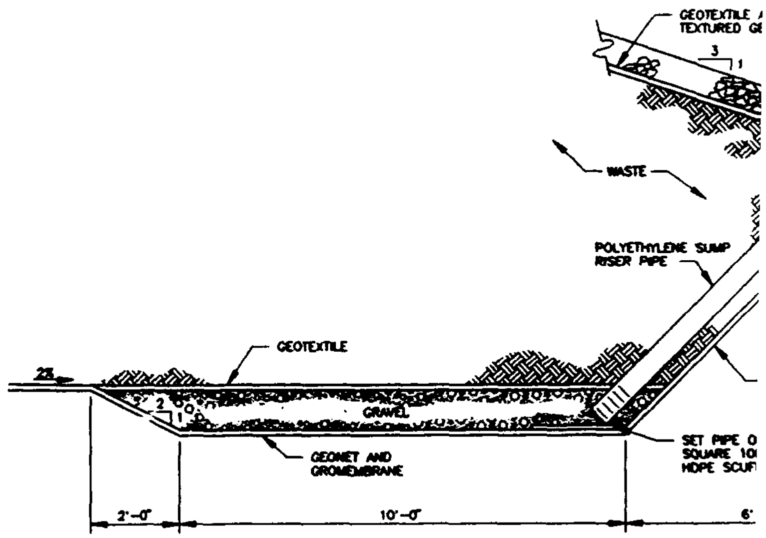
CELL CAP DETAIL

NTS

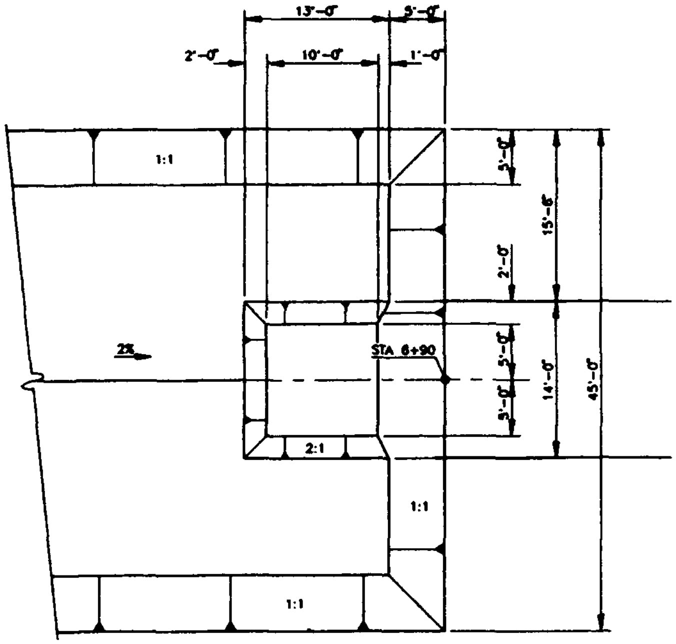


CELL LINER DETAIL

NTS



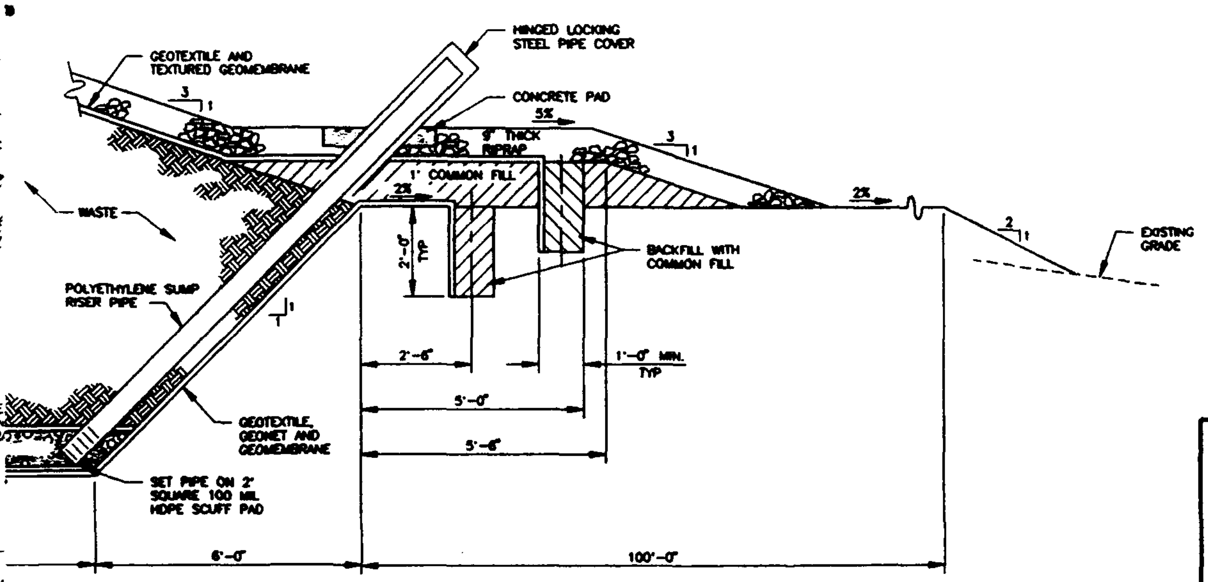
DWG. NO.	DESCRIPTION	DWG. NO.	DESCRIPTION		BY
REFERENCE DWGS.		REFERENCE DWGS.		REVISIONS	



SUMP PLAN

(TYPICAL, EACH CELL)

SCALE : 1/8 INCH = 1 FOOT



SUMP SECTION

(GEOSYNTHETIC THICKNESSES NTS)

SCALE : 1/2 INCH = 1 FOOT

DRAWING REDUCED 50%

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BY	DATE	REVISIONS	BY	DATE	DISTRIBUTION
		DRAFT PRELIMINARY DESIGN (OAS REVIEW)		05/15/92	
		DRAFT PRELIMINARY DESIGN		04/22/92	

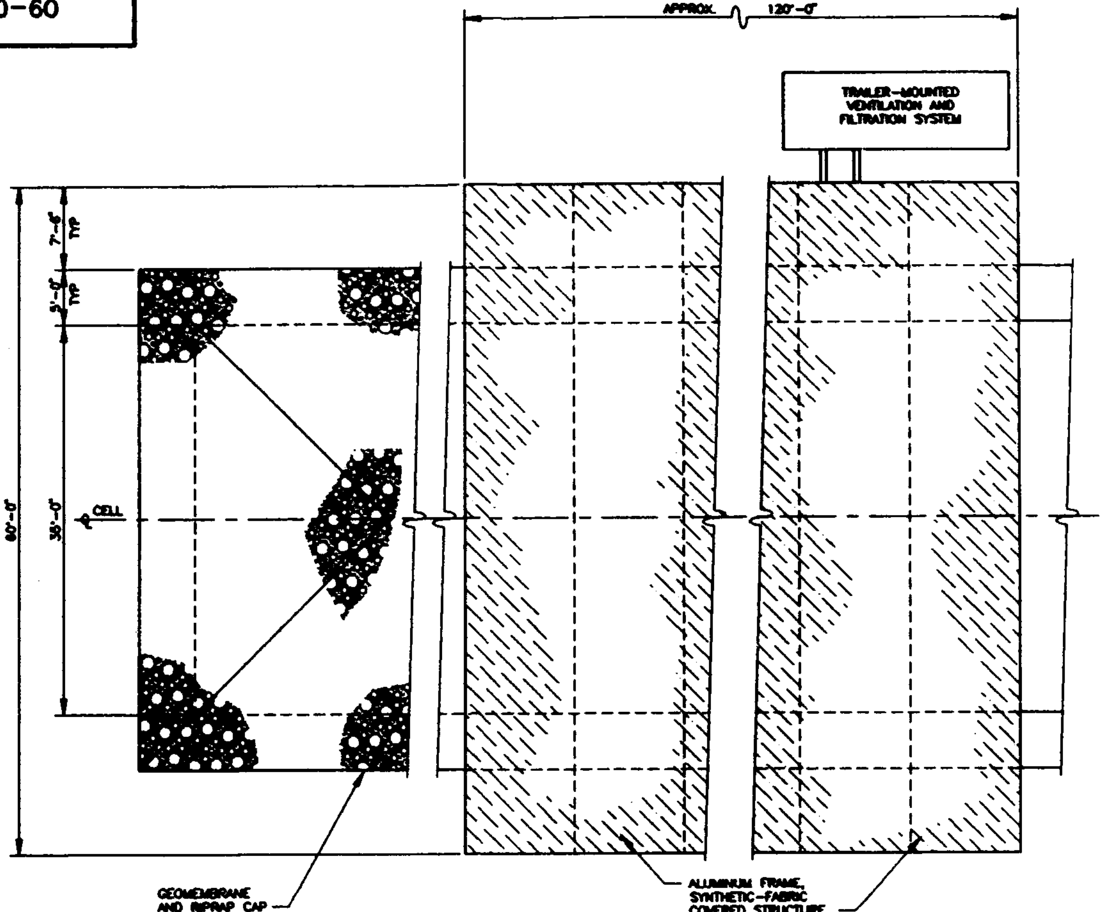
SCALE: AS SHOWN
DESIGN: MTZ
DRAWN: SLF
CHECK: RJD
APP.:
DATE: 04/02/92

CLIENT : ROCKY MTN. ARSENAL
LOCATION : COMMERCE CITY, COLORADO

CELL DETAILS
SHEET 5 OF 7

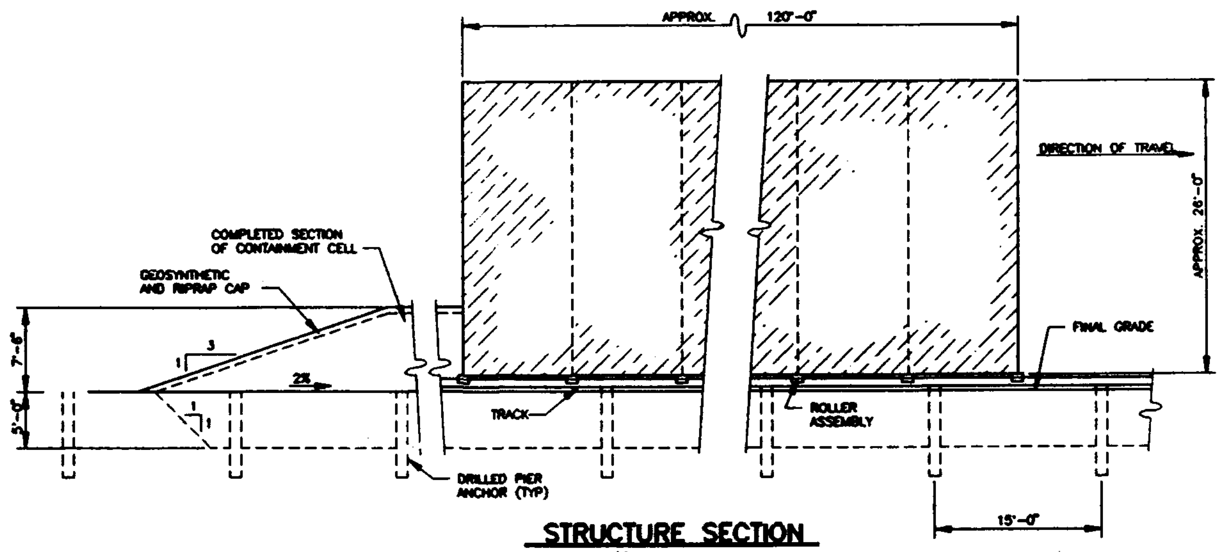
CONTRACT NO.	OWNER NO.	DRAWING NO.	REV. NO.
22831	N/A	08-02-004	B

09-02-005



STRUCTURE PLAN

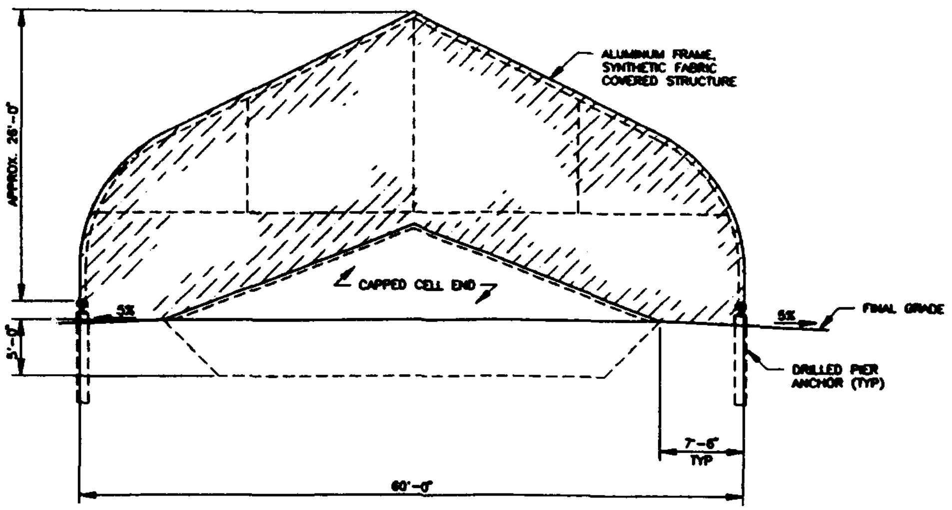
SCALE : 1/8 INCH = 1 FOOT



STRUCTURE SECTION

SCALE : 1/8 INCH = 1 FOOT

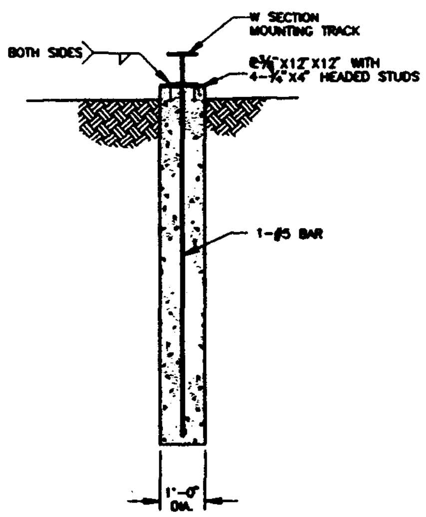
DWG. NO.	DESCRIPTION	DWG. NO.	DESCRIPTION	REVISIONS	BY	DA
REFERENCE DWGS.		REFERENCE DWGS.		REVISIONS	BY	DA



SOUTH END ELEVATION

SCALE : 1/8 INCH = 1 FOOT

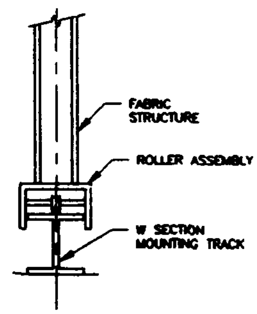
12' 0 10'



DRILLED PIER ANCHOR

SCALE : 1/2 INCH = 1 FOOT

12" 0 1' 2' 3' 4'



ROLLER ASSEMBLY DETAIL

NTS

DRAWING REDUCED 50%

BY	DATE	REVISIONS	BY	DATE
		DRAFT PRELIMINARY DESIGN (OAS REVIEW)		05/15/92
		DRAFT PRELIMINARY DESIGN		04/08/92

DISTRIBUTION

SCALE	AS SHOWN
DESIGN	MTZ
DRAWN	SLF
CHECK	RJD
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DATE	04/22/92

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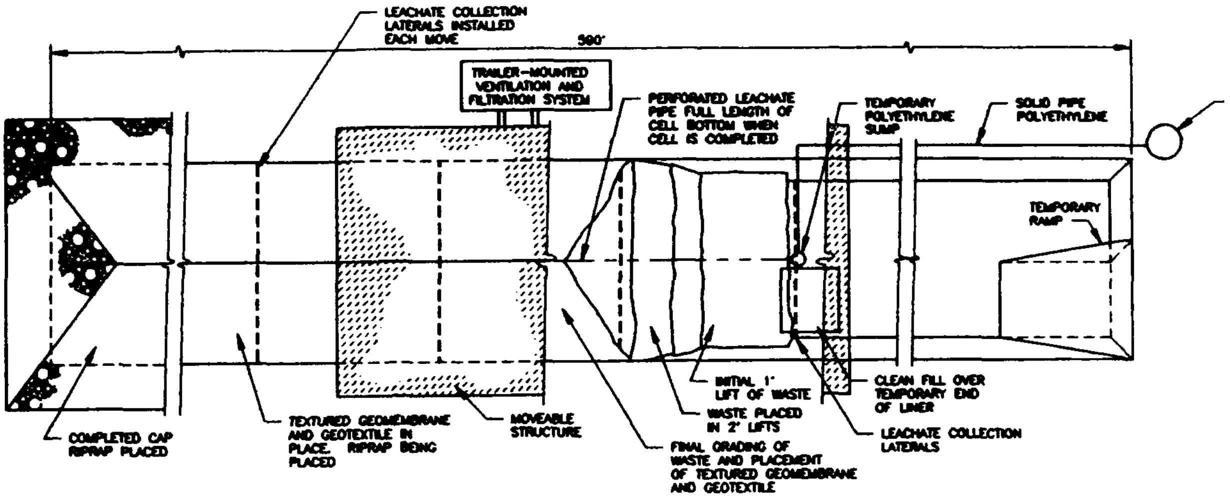
CLIENT : ROCKY MTN. ARSENAL

LOCATION : COMMERCE CITY, COLORADO

STRUCTURE DETAILS
SHEET 6 OF 7

CONTRACT NO.	OWNER NO.	DRAWING NO.	REV. NO.
22831	N/A	08-02-006	B

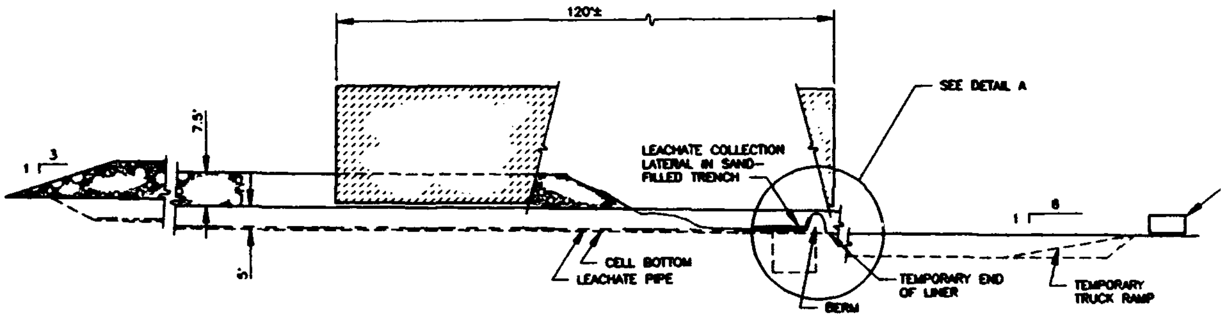
09-02-006



OPERATION-PLAN VIEW

SCALE : 1 INCH=20 FEET

20' 0 20'

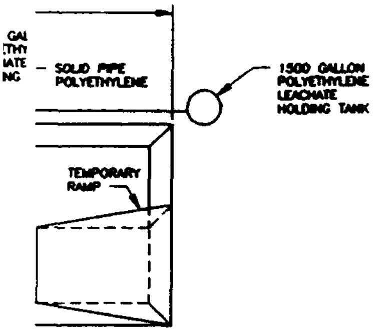


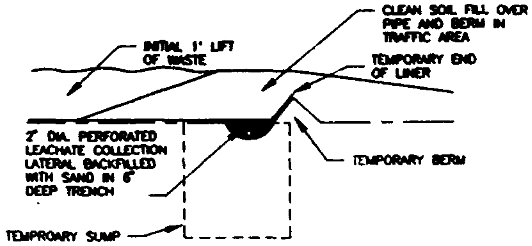
OPERATION-PROFILE VIEW

SCALE : 1 INCH=20 FEET

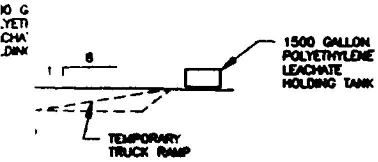
20' 0 20'

DWG. NO.	DESCRIPTION	DWG. NO.	DESCRIPTION		BY	D
REFERENCE DWGS.		REFERENCE DWGS.		REVISIONS	BY	D





DETAIL A
TEMPORARY LINER END
NTS



DRAWING
REDUCED
50%

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REV.	REVISIONS	BY	DATE
1	DRAFT PRELIMINARY DESIGN (OAS REVIEW)		05/15/92
0	DRAFT PRELIMINARY DESIGN		04/08/92

DISTRIBUTION

SCALE	1"=20'
DESIGN	MTZ
DRAWN	SLF
CHECK	RJD
APP.	
DATE	04/22/92

CLIENT : ROCKY MTN. ARSENAL
LOCATION : COMMERCE CITY, COLORADO

OPERATION PLAN
SHEET 7 OF 7

CONTRACT NO.	OWNER NO.	DRAWING NO.	REV. NO.
22831	N/A	09-02-006	1